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ATTACHMENT D
BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A
SCOPE OF WORK

EXHIBIT A-1 – SCOPE OF WORK (BESS BOP)

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ATTACHMENT D
BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A-1
SCOPE OF WORK (BESS BOP)

ATTACHMENT 1 – CONTRACTOR PROJECT SCHEDULE REQUIREMENTS

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ATTACHMENT 3 – APPLICABLE STANDARDS

EXHIBIT A-1 SCOPE OF WORK (BESS BOP)

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ATTACHMENT 1 – CONTRACTOR PROJECT SCHEDULE REQUIREMENTS

ATTACHMENT 2 – PROJECT COORDINATION AND MEETINGS

ATTACHMENT 3 – APPLICABLE STANDARDS

EXHIBIT A-1
SCOPE OF WORK (BESS BOP)

1.0 EXHIBIT INFORMATION

1.1 Project Description

1.1.1 See Section 1.0 of Exhibit B-1 (*Project Specific Information*).

1.1.2 Owner shall procure the BESS system for the Project which shall consist of purpose-built enclosures (PBEs), Power Conversion Systems (PCS), and the Energy Management System (EMS). Contractor shall install the BESS system and engineer, procure, and construct the remaining facility systems.

1.1.3 Contractor shall coordinate design with other engineering firms responsible for scope outside of the Agreement as set forth in Exhibit E-1 (*Division of Responsibility*).

1.2 Purpose

1.2.1 This Exhibit defines the minimum scope, features, and quality standards for the design, procurement, construction, testing, and commissioning of the new BESS facility.

1.3 References

1.3.1 This Exhibit shall also be used in conjunction with Exhibit A-2 (*Scope of Work (HV)*), Exhibit A-3 (*Scope of Work (BESS)*), Exhibit A-4 (*Performance Testing Procedures (BESS)*), and the documents in Exhibit B-1 (*Project Specific Information).* This Exhibit, Exhibit A-2 (*Scope of Work (HV)*), Exhibit A-3 (*Scope of Work (BESS)*), Exhibit A-4 (*Performance Testing Procedures (BESS)*), and the documents in Exhibit B-1 (*Project Specific Information*) are intended to supplement, but not necessarily duplicate, each other; any Work exhibited in one and not the other shall be executed as if it had been set forth in both. In the event of any conflicts between the information in Exhibit A-2 (*Scope of Work (HV)*), Exhibit B-1 (*Project Specific Information*), and this Exhibit, the more stringent requirement shall prevail.

1.4 Definitions

1.4.1 Unless defined in this Exhibit, terms that begin with an upper case shall have the meaning defined in the Agreement.

1.4.2 For purposes of Exhibit A through Exhibit F, the following words shall have the respective meanings set forth below.

(1) "**AC**" or "**ac**" shall mean alternating current.

(2) "**Agreement**" shall mean the Engineering, Procurement, and Construction Agreement to which this Exhibit is attached. In the event of a conflict between the body of the Agreement and this Exhibit, the body of the Agreement shall take precedence.

(3) "**AHJ**" Shall mean any Authority Having Jurisdiction for the BESS Project.

(4) "**Applicable Law**" has the meaning set forth in the Agreement.

(5) "**Applicable Permits**" has the meaning set forth in the Agreement.

(6) "**Applicable Standards**" means the minimum standards and industry codes by Contractor, including those set forth in Attachment 3 (*Applicable Standards*) to this Exhibit.

(7) "**Auxiliary Loads**" means power consumption not directly associated with System Losses. These include, but are not limited to, EMS and other control systems, thermal management systems, communications equipment, and other miscellaneous equipment loads. The PCS auxiliary power requirements shall be included as a System Loss unless the PCS requires a separate auxiliary power feed (see definition of System Loss).

(8) "**As-Built Drawing**" means a complete set of drawings prepared by Contractor or a Subcontractor which accurately and completely represent the Work as constructed and installed.

(9) "**Battery Energy Storage System** "(**BESS**)" means the comprehensive energy storage system Equipment and Materials including the batteries, racks, purpose-built enclosures, cabling, power combiners, PCS including inverters and medium voltage transformers, collection system, and switchgear.

(10) "**Battery Management System** "(**BMS**)" means an electronic system that manages a rechargeable battery (cell or battery pack), such as by protecting the battery from operating outside its safe operating area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it and/or balancing it.

(11) "**Balance of Plant**" "(**BOP**)" means all supporting components and ancillary systems necessary for completion of Project, other than the BESS itself, including but not limited to auxiliary power distribution equipment and cabling, communication systems, foundations and support structures, and civil site development.

(12) **"Business Day"** means any day except a Saturday, Sunday, or a Federal Reserve Bank holiday in the state that the Project is located. A Business Day begins at 8:00 a.m. and ends at 5:00 p.m. local time.

(13) "**Calendar Day**" or "**Day**" means any day that begins at 12:00 a.m. local time and ends 24 hours later.

(14) "**Collection System Circuit**" means the permanent electrical and communications infrastructure required to transmit energy and performance and operating data between the BESS and the Project Substation, or to the EMS control panel as appropriate.

(15) "**Communications System**" means the networking and communications hardware and software (including as switches, routers, firewalls, patch panels) connecting the BESS, owner equipment, supervisory, control and data acquisition system (SCADA), and dispatching hardware, as well as all communications cabling and supporting devices within the Collection System Circuits.

(16) "**Contractor**" means the person, firm, or corporation with whom Owner has entered into the Agreement. For the purposes of this definition, "Contractor" means EPC Contractor.

(17) "**Contractor Permit**" means those applicable permits that shall be acquired by Contractor.

(18) **"Contractor Deliverables"** means all deliverables and submittals necessary for the successful completion of the Work, including, but not limited to Job Books, As-Built Drawings, as-built data files (.DWG, .SHP, etc.), completion certificates, design documents, and all other manuals, drawings, plans, studies, calculations, safety-related documentation, reports, checklists, completion procedures, and other similar items.

(19) "**Contract Documents**" means those documents that are designated by the Agreement to define the Work to be performed as part of the Agreement, including but not limited to Project specifications, drawings, exhibits, schedules, and attachments.

(20) "**Contract Price**" means an amount to be paid to Contractor by Owner as full and complete payment for all Work to be performed by Contractor under the Agreement.

(21) "**DC**" or "**dc**" means direct current.

(22) "**DC-DC Converter**" means the electrical equipment that adjusts the DC voltage on the input terminal to match a specified output voltage.

(23) "**DSM**" means Dynamic System monitor as part of the SCADA system.

(24) "**Energy Management System**" "(**EMS**)" refers to a controls system that is responsible for control and/or monitoring of equipment, including but not limited to battery contactor, BMS, PCS, breakers, fire protection, HVAC, and metering. EMS also reports real-time site data along with relevant predicted, historical, and/or calculated data to the SCADA system for monitoring, to the operator or other entity for dispatching of the BESS or other generation unit with or without Operator interference. EMS includes all modes of control including, but not limited to Power Plant Controller (PPC) for full closed loop control, MW Control, MVaR Control, Frequency Response, Voltage Response and Voltage Ride Through. EMS shall include firewall network hardware for remote site access.

(25) "**Emergency Response Plan**" "(**ERP**)" means a pre-incident plan for use by personnel responding to emergencies to assist personnel in effectively managing incidents and events for the protection of responding personnel, property, and the environment.

(26) "**Engineer of Record**" "(**EOR**)" means the professional engineer licensed in the jurisdiction of the Project and responsible for all aspects of engineering and construction of the respective design as it relates to their specific discipline.

(27) "**Equipment**" means all of the parts, components, materials, apparatus, structures, tools, supplies, consumables, goods, and other items required or appropriate for a complete, fully-functional Project or that otherwise form or are intended to form part of the Work or the Project, *including* all materials, apparatus, structures, tools, supplies and other goods provided and used by Contractor and the subcontractors for performance of the Work, but that are not incorporated into the Project.

(28) "**FNTP**" means Full Notice to Proceed.

(29) "**Failure Modes and Effects Analysis**" "(**FMEA**)" means a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of the different failures, in order to identify the parts of the process that are in need of change.

(30) "**Gen-Tie**" means the interconnection line that connects the Project to the interconnecting utility's grid.

(31) "**Hazard Mitigation Analysis**" "(**HMA**)" means the Failure Modes and Effects Analysis or other approved hazard mitigation analysis required by IFC and NFPA 855 to evaluate the consequences of various failure modes.

(32) "**HMI**" means Human Machine Interface and shall refer to the user interface for the Owner, Contractor, and operator to interface with the EMS.

(33) "**HSSE Plan**" means collectively the health and safety plan, the security plan, and the environmental plan specific to the Project and Project Site.

(34) "**HV**" means high voltage.

(35) "**HVAC**" means heating, ventilation, and air conditioning.

(36) "**Hertz**", or "**Hz**" means hertz.

(37) "**Job Book**" means a manual to be prepared by Contractor and approved by Owner, which shall include all Contractor engineering, design, purchasing, and other information relating to the Work.

(38) "**Inverter**" means Power Conversion System (PCS).

(39) **kV**" means kilovolts.

(40) "**kW**" means a measure of power as measured in kilowatts. If not specified it shall be assumed to be in Alternating Current (AC).

(41) "**kWh**" means a measure of energy as measured in kilowatt-hours. If not specified it shall be assumed to be in Alternating Current (AC).

(42) "**Main Power Transformer**" "(**MPT**)" means the main transformer located in the Project Substation required to change the voltage to match the voltage at the POI.

(43) "**Materials**" means products substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.

(44) "**Mechanical Completion**" means completion of the battery PBE, including documentation of installation and pre-energization checks in accordance with the instructions set forth in the installation manual and any checklists provided by the Supplier.

(45) "**MSDS**" means Material Safety Data Sheet.

(46) "**MV**" means medium voltage.

(47) "**MW**" means a measure of power as measured in megawatts. If not specified it shall be assumed to be in Alternating Current (AC).

(48) "**MWh**" means a measure of energy as measured in megawatt-hours. If not specified it shall be assumed to be in Alternating Current (AC).

(49) "**NRTL**" means Nationally Recognized Testing Laboratory.

(50) "**NTP**" means Notice to Proceed.

(51) "**OSHA**" means Occupational Safety and Health Administration.

(52) "**Owner**" means Owner of the Project as provided in Section 2.0 of Exhibit B-1 (*Project Specific Information*).

(53) "**Owner Permit**" means any applicable permits that are acquired by Owner.

(54) "**Owner's Representatives**" means a person, firm, or corporation with whom Owner has entered into a separate agreement.

(55) "**Overbuild**" means the desired excess energy of battery, in MWh, to be built at the beginning of the Project life at the POI.

(56) "**Point of Interconnection**" "(**POI**)" means the point where the interconnection line connects to the interconnection facilities constructed and owned by the interconnecting utility to which electrical power produced by the Project shall be delivered.

(57) "**Power Conversion System**" "(**PCS**)" means a bi-directional AC/DC inverter typically combined with a transformer system DC connected to the battery system and AC interconnected typically to the Project Substation. If not specified otherwise, then the medium voltage step-up transformer shall be assumed to be included with PCS.

(58) "**Project**" means the Project name as provided in Section 2.0 of Exhibit B-1 (*Project Specific Information*).

(59) **"Project Schedule"** means a detailed Project schedule that reflects the Project execution plan and anticipated sequence of site operations.

(60) "**Project Site**" means the location of the Project as provided in Section 2.0 of Exhibit B-1 (*Project Specific Information*).

(61) "**Project Substation**" means the substation that connects the Project to the interconnection line and the interconnecting utility's grid.

(62) "**Purpose Built Enclosure**" "(**PBE**)" means the weather-proof battery equipment enclosure that can contain the battery modules, battery racks, BMS, and integrated thermal management system. Dependent on supplier it can also contain inverters and local fire detection and/or suppression.

(63) "**Raceway**" means all conduit (rigid and flexible), underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

(64) "**Requirements**" means the Specifications in Project Exhibits, battery energy storage industry practices, Applicable Law, Applicable Permits, Applicable Standards, Project Schedule, interconnection agreement, utility specifications, Equipment manufacturers' requirements, AHJ requirements, and other requirements of the Agreement.

(65) "**RFI**" means Request for Information.

(66) "**RTU**" means Remote Terminal Unit.

(67) "**SCADA**" means the Facility's supervisory control and data acquisition system, which may include equipment installed by the Contractor. The SCADA system shall be for monitoring only and separate from the EMS Controls.

(68) "**Specifications**" means those portions of the Agreement consisting of written technical descriptions of the Work, and covering the Equipment, Materials, workmanship and certain administrative details applicable thereto.

(69) "**SPCC Plan**" means a spill prevention, control, and countermeasure plan.

(70) "**Subcontractor**" means an individual, firm, or corporation having a direct contract with Supplier, EPC Contractor, or any other Subcontractor for the performance of a part of the Work.

(71) "**Submittal Schedule**" means the schedule for Contractor's delivery of submittals, as set forth in Exhibit C-2 (*Submittal Schedule*).

(72) "**Supplier**" means the person, firm, or corporation with whom Owner has entered into a battery procurement agreement. For the purposes of this Exhibit, "Supplier" means Battery Integrator.

(73) "**Substantial Completion**" means the completion to the satisfaction of the Owner (or waiver in writing by Owner) per the requirements set forth in Section 5.19 of this Exhibit.

(74) "**System Loss**" or "**System Losses**" means power consumed by cables, buses, PCS, transformers, and transmission lines. Supplier shall specify if System Losses are inclusive of battery losses. Supplier shall include PCS auxiliary power as a System Loss if no separate auxiliary power feed to the PCS is required or Supplier shall include PCS auxiliary power as an Auxiliary Load if a separate auxiliary power feed to the PCS is required (Supplier shall determine if a separate auxiliary power feed to the PCS is required).

(75) "**UPS**" means Uninterruptible Power Supply.

(76) "**Unsuitable Material**" means materials that contain debris, roots, organic matter, frozen matter, rock, or other materials unsuitable for providing acceptable fill or subgrade for roads and structures.

(77) "**Work**" means all actions, capital, contracts, labor, Equipment, and Materials necessary to construct the proposed Project (including operating the Project) to provide to Owner at the specified delivery point.

(78) "**Working Day**" refers to Contractor's calendar days given for working. Typically, these days exclude Federal holidays and weekend days that are usually not worked. Working days need to be agreed to before baseline schedule is accepted.

2.0 GENERAL SERVICES

2.1 General Provisions

2.1.1 Contractor shall construct a utility-scale Battery Energy Storage System (BESS) Project for the Owner at the specified power capacity and energy production.

2.1.2 BESS Project shall be capable of operating safely and reliably in accordance with the terms and conditions of the Agreement, this "Scope of Work", and associated Exhibits.

2.1.3 Contractor shall design and construct the BESS Project in accordance with the Agreement and the Requirements and in coordination with Exhibit A-2 (*Scope of Work (HV)*), Exhibit A-3 (*Scope of Work (BESS)*), and Exhibit A-4 (*Performance Testing Procedures (BESS)*). Scope of Work shall consist of:

(1) Specify, receive, furnish, store, and install the Equipment and Materials including, but not limited to foundations, DC cables, AC cables, auxiliary transformers, switchboards, panelboards, lighting, grounding, ancillary hardware, and Equipment required to connect and operate listed Equipment.

(2) Project design engineering, software models, and drawing packages for construction permitting, installation, and "as-built" documentation.

(3) Project design and construction including all site/civil work, structural, electrical, mechanical, fire protection, monitoring/control systems, and fencing.

(4) Project and construction management, including quality assurance/quality control, site safety, site material control, and management of all Subcontractors.

(5) Security requirements according to Owner's standards, as applicable.

(6) Spare parts, special tools, lubricants, and consumables required for complete installation and commission shall be included in the proposal.

(7) Third-party inspections as required.

(8) Contractor to submit 30%, 90%, and Issue for Construction (IFC) Design Review meeting plan for Owner approvals. All design review meetings shall be held at agreed upon meeting place and may be broken up into several meetings as required to meet schedule. At the Owner's request, design review meetings shall be conducted virtually.

(9) Contractor shall perform any pre-operational testing, startup, and support of performance testing and component equipment testing unless expressly identified to be the responsibility of the Supplier. If Supplier is responsible, Contractor shall coordinate and schedule appropriate testing and commissioning with Supplier. Project commissioning and testing shall be in accordance with these Exhibits, Contractor standards, and Equipment manufacturers' requirements, as approved by Owner.

(10) BESS Project turnover including Owner/Operator training, BESS Project operations and maintenance documentation, and Equipment warranty documentation.

2.1.4 The Project shall have minimum and maximum design temperatures as provided in Section 3.0 of Exhibit B-1 (*Project Specific Information*) at 100% of the proposed contract capacity and duration for discharging.

2.1.5 Minimum design working life shall be as provided in Section 2.0 of Exhibit B-1 (*Project Specific Information*).

2.1.6 Contractor shall not proceed with any portion of the Work until the applicable NTP has been provided.

2.1.7 Contractor shall be responsible for obtaining all required construction and building permits. Contractor shall provide all design documents required to support Owner in obtaining any Owner Permits (if required) and other regulatory agreements.

2.1.8 Contractor shall design all aspects of the Project based on verifiable criteria that are specific to the Project and Project Site, including elevation, terrain, ground cover/vegetation, corrosivity, precipitation (rain, snow, ice), frost depth, seismic, wind, and subsurface conditions. All such design criteria shall be as provided in Exhibit B-1 (*Project Specific Information)*.

2.1.9 Notwithstanding any reference to specific codes or standards herein, all Work shall comply with the Applicable Standards. The method for handling conflicts between Applicable Standards shall be as set forth therein.

2.1.10 Requirements for special tooling:

(1) Contractor shall utilize tooling in accordance with manufacturer recommendations, including any Supplier guidelines for use of special tools.

2.1.11 Contractor shall prepare As-Built Drawings along with their respective native design files (DWG, DGN, KMZ, etc.) as may be necessary to meet the standards of the AHJ. At a minimum, Contractor shall prepare As-Built Drawings for the Owner's record which contain As-Built elevations, dimensions, etc. and any variation from the design drawings, sealed by a licensed engineer or surveyor in the jurisdiction of the Project, if required.

(1) As-Built Drawing format shall comply with Exhibit D-1 (*MP CAD Standards*).

2.1.12 Contractor shall provide structural calculations sealed by a licensed engineer in the jurisdiction of the Project for all structural supports and foundations in accordance with Applicable Standards.

2.1.13 Contractor shall perform studies to determine the parameters for the Project's grounding system. Such studies shall identify step and touch potentials, as applicable. Designs and study shall adhere to IEEE 80 and IEEE 142 where applicable.

2.1.14 Contractor shall provide electrical studies as required to determine control response and settings, including but not limited to:

(1) Load flow, short circuit, arc flash, voltage drop, harmonic study, reactive power study, insulation coordination, transient overvoltage, power system stability, power quality, and electromagnetic compatibility.

2.1.15 Contractor shall provide complete documentation of all protective relay and Project control settings. Such documentation shall include all calculations and coordination curves used in the development of the settings.

2.1.16 Contractor shall provide a BESS installation and associated systems in compliance with NFPA 855 and the local fire code.

2.1.17 All design dimensions and design calculations shall be in United States Customary units.

2.2 Site Conditions

2.2.1 Contractor shall inspect the Project Site prior to initiating the Work to obtain, or plan to obtain, such additional or supplementary examinations, investigations, explorations, surveys, tests, studies, and/or data concerning conditions at or contiguous to the Project Site or otherwise, which may affect cost, progress, performance, or furnishing of the Work. All such inspections shall be obtained and executed pursuant to the Project Schedule.

2.2.2 Any existing infrastructure, including but not limited to communications towers, pipelines, telephone lines, and electrical lines, shall be left in their current condition throughout the construction of the Project. Any existing access to the Project Site shall remain open throughout construction.

2.3 Construction Management

2.3.1 Contractor shall furnish all management, supervision, indirect and direct construction labor, technical direction, construction management, construction scheduling, tools, construction equipment, construction services and utilities, safety and loss control program, quality control program, procurement expediting, manufacturer's field services, and all items required for the handling, installation, erection, startup, and placing all Equipment into operation.

2.3.2 Contractor shall provide traffic control that complies with local regulations and/or permits at and within the Project Site, or as otherwise required to complete the Work, including, but not limited to, traffic control along any public roads, as required. Traffic control shall be subject to the approval of the local AHJ.

2.3.3 Contractor shall provide all necessary construction water, including, but not limited to that which is required for temporary work, subgrade and concrete preparation, dust control, rock drilling operations, and pressure washing of Equipment.

2.3.4 Contractor is responsible for temporary power and communication services for BESS Project during construction.

2.3.5 Contractor shall provide all necessary fire management devices, per the fire management plan to be prepared by Contractor, including water trailers, construction vehicle fire kits, or other similar devices, as applicable.

2.3.6 Contractor shall attend and actively participate in Owner-scheduled Project meetings. These meetings may include, but are not limited to:

(1) Engineering update meetings to review progress against the Project Schedule, address issues related to the Work, and other similar items prior to construction of the Project.

(2) Project management meetings during construction, Project Schedule progress, weekly management updates, and monthly management updates.

2.3.7 Contractor shall contact local authorities, pipeline companies, and utility companies to locate conflicting underground facilities *prior* to starting any excavation or trenching Work. Contractor shall be responsible for all damages resulting from contact with identified underground facilities in the vicinity of each excavation.

2.3.8 Contractor shall prepare, implement, and maintain a Stormwater Pollution Prevention Plan (SWPPP) specific to the Project Site for its construction activities in accordance with AHJ requirements.

2.3.9 Contractor shall regularly inspect Equipment delivery trucks and other equipment for leaks, including oil, coolant, and hydraulic fluid. Notwithstanding the foregoing, all inspections required by the SWPPP shall be conducted by the Contractor.

2.4 Project Documentation

2.4.1 Contractor shall prepare and submit Contractor Deliverables. All Contractor Deliverables shall be subject to review and/or approval by Owner, submitted by the applicable dates set forth in the Submittal Schedule, and meet the minimum requirements for submittals set forth in Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*). The following list provides an indicative sample of Owner requirements for specific Contractor Deliverables for the sole purpose of ensuring clarity of expectations for the referenced submittals; *this list is not intended to be an exhaustive listing of all Contractor Deliverables or the requirements thereof*.

(1) Contractor shall prepare, implement, and manage a Project Schedule that complies with the minimum requirements outlined in Attachment 1 (*Contractor Project Schedule Requirements*) to this Exhibit.

(2) Contractor shall also provide an individual (the "**Scheduler**") who shall:

(a) Be dedicated to the Project upon start of construction.

(b) Develop and maintain the Project Schedule.

(c) Be an experienced specialist that is skilled in critical path method scheduling.

(d) Attend (either remotely or in person) and actively participate as needed in all Project meetings related to construction progress, alleged delays, or time impact.

(3) Contractor shall prepare, implement, manage, and observe the HSSE Plan. This plan shall conform to the minimum requirements set forth in this Agreement.

(4) Contractor shall prepare, implement, and manage a detailed quality assurance plan that is specific to the Project and Project Site. This plan shall conform to the minimum requirements set forth in this Agreement.

(5) Contractor shall provide one (1) complete copy of the Job Book in electronic format uploaded to the Owner's web-based document management system for the Project Site. Job Books shall conform to the minimum requirements set forth in Exhibit C-1 (*Contractor Deliverables*) and in Exhibit C-2 (*Submittal Schedule*).

(6) Contractor shall prepare, implement, and manage a detailed project execution plan that is specific to the Project and encompasses the Work at the Project Site. The project execution plan shall be sufficient in scope and detail to convey the means and methods that shall be employed by Contractor to perform all aspects of the Work. Key elements of the project execution plan shall include, but not be limited to:

(a) Project management structure and key personnel.

(b) Roles and responsibilities.

(c) Staffing plans.

(d) Communications protocol.

(e) Engineering execution plans.

(f) Security plans, including, but not limited to guards/patrols, weapons, emergency procedures, and incident notification procedures.

(g) Construction management plans, including, but not limited to cost controls, schedule controls, mobilization, document management, materials management, details for receipt and transport of equipment, traffic management (including concrete trucks), construction sequencing, movement of cranes during construction, and other similar items.

(7) Contractor shall prepare, implement, and manage a traffic management plan that is specific to the Project and Project Site. The traffic management plan shall define and implement temporary traffic control measures as required by applicable county or local agencies throughout construction duration to ensure safe site access from nearby public roads for all vehicles, Equipment and deliveries supplied by Contractor. The traffic management plan shall be subject to alteration at the direction of the Owner, Engineer of Record, or AHJ, or as necessary to ensure and promote safety on and off the Project site.

(8) Contractor shall prepare, implement, and manage critical lift plans that are specific to the Project and Project Site. Requirements for the critical lift plans are as follows:

(a) Critical lift plan shall clearly identify precautions for all critical lifts, include a coordination plan (including pre-lift meetings with all participating personnel), and include sample documentation/checklists for all critical lifts.

(b) Prior to performing any critical lift, Contractor shall perform a practice lift with a similar crane configuration and load configuration. Practice lifts shall always be performed with the same crew and using the same lifting equipment as those used for the critical lift; to the extent that Contractor has successfully performed a practice lift, any subsequent, identical lifts shall not require another practice lift.

(c) Any lift exceeding 95% of a crane's load chart is prohibited.

(d) For purposes of this Exhibit, a "critical lift" shall include, at a minimum, the following:

1. Any lift that exceeds 75% of the rated capacity of the crane, per the respective crane's load chart.

2. Any lift that exceeds 50,000 pounds.

3. Any lift that requires the use of more than one crane.

4. Any lift requiring blind picks.

5. Any man-basket lifting operation.

6. Any load that is lifted/transported over or near energized electrical equipment, such as power lines, transformers, or switchgear.

7. Any lift in a confined space or restricted area (including an operating facility) where the load, or any part of the crane or equipment structure, could come within three (3) feet of any existing structure.

8. Any lift where the equipment is set up near manholes, catch basins, sewers, sinkholes or other known surface or sub-surface interferences.

(9) Contractor shall prepare and implement a SPCC Plan in accordance with EPA requirements for the duration of Project construction.

(a) Contractor shall routinely inspect equipment for leaks, including oil, fuel, and hydraulic fluid. All inspections required by the SPCC Plan shall be conducted by the Contractor.

(10) Contractor shall prepare a FMEA or other approved HMA in accordance with NFPA 855 and the local fire code for the Project and Project Site to evaluate the consequences of the following:

(a) A thermal runaway condition in a single BESS rack, module, or unit.

(b) Failure of any battery management system.

(c) Failure of any required ventilation or exhaust system.

(d) Voltage surges on the primary electric supply.

(e) Short circuits on the load side of the BESS.

(f) Failure of the smoke detection, fire detection, fire suppression, or gas detection system.

(g) Required spill neutralization not being provided or failure of a required secondary containment system.

(h) Failure of an energy storage management system or protection system that is not covered by the product listing FMEA.

(11) Contractor shall prepare, implement, and maintain an ERP for the Project and Project Site during construction, initial acceptance testing, and commissioning.

(12) Contractor shall prepare all construction documents, analyses, and calculations required by the AHJ for the Project Site in accordance with Applicable Standards. Contractor is responsible for verifying details for the Project Site and coordinating with the applicable AHJ.

(13) Contractor shall prepare all initial acceptance testing procedures required by the AHJ for the Project in accordance with Applicable Standards.

2.4.2 Contractor shall upload electronic copies of all Contractor Deliverables (including drafts and final) to Owner’s web-based document management system.

2.4.3 Contractor shall prepare and maintain a documentation list for the Project. This list shall include, at a minimum, a listing of all Contractor Deliverables and the status (including responsible party) and revision number of each. The naming and labeling conventions for all Contractor Deliverables shall be coordinated with and approved by Owner. The documentation list shall be updated by Contractor each time a new or revised drawing or document is issued, at a minimum, including identifying any open and/or pending submittals for review.

2.4.4 Contractor shall prepare and maintain a complete log, including supporting documentation, of all submittals, transmittals, and RFIs issued between Owner and Contractor throughout performance of the Work. This log shall include, at a minimum, a listing of each RFI and the status (including responsible party) and revision number of each. The naming and labeling conventions for all RFIs shall be coordinated with and approved by Owner. The documentation list shall be updated by Contractor each time a new or revised RFI is issued, at a minimum.

2.4.5 Contractor shall provide to Owner periodic written reports as to the actual progress of the Work in comparison to the Project Schedule in accordance with Attachment 1 (*Contractor Project Schedule Requirements*) to this Exhibit.

2.4.6 Contractor shall maintain colored hard copies of all issued-for-construction drawings at the Project Site during performance of the Work, including at least one (1) complete set in Owner's office trailers. Such hard copies shall be updated by Contractor upon issuance of any revised issued-for-construction drawing. Contractor shall separately maintain a complete set of controlled redline drawings showing all Owner-approved changes made during construction, including reference to the applicable RFI number, and such redlines shall be included in the Job Books.

2.5 Signage

2.5.1 Contractor shall furnish, install, and maintain throughout the performance of the Work all signage required by the Applicable Permits, the Applicable Standards, and other applicable Requirements. All signage and equipment marking (including numbering and labeling) shall be approved by Owner prior to installation.

2.5.2 Contractor shall furnish and install identification numbers and permanent, weatherproof labels on all interconnection line structures.

2.5.3 Contractor shall furnish, install, and maintain above-ground "buried cable" marker signs at all locations where an underground Collection System Circuit crosses a road, fence, or underground utility respectively.

2.5.4 Contractor shall furnish, install, and maintain signage as needed to provide reasonable information and direction to Project Site personnel and to facilitate orderly entrance and egress from the Project Site. Contractor shall also furnish, install, and maintain signage identifying personnel assembly locations for use during emergencies or Project Site evacuations.

2.5.5 Contractor shall furnish and install emergency response (E-911) address signs in accordance with local authorities and owner standards.

2.5.6 Contractor shall uninstall, remove, and discard all temporary signage at the completion of the Work, or as otherwise prescribed in the Applicable Permits. Temporary signage shall be legible and of sufficient durability to last the duration of construction activities.

2.5.7 Signage shall be provided to meet the requirements of NFPA 70, UL 9540, NFPA 855, and the local fire code.

2.6 Permits

2.6.1 Contractor shall obtain, pay for, and maintain all permits required for its performance of the Work at the Project Site. Contractor shall provide copies to Owner of all permit applications for Contractor Permits promptly after such applications are submitted to the applicable authority.

2.6.2 Contractor shall maintain copies of all permits at the Project Site during construction of the Project and shall at all times comply with all requirements of Contractor Permits, including closeout of such permits, and shall transfer to Owner such permits required for the operation and maintenance of the Project.

2.6.3 Contractor shall provide reasonable assistance, including engineering support, to Owner in applying for, obtaining, and maintaining any Owner Permits.

2.6.4 Contractor is responsible for flood plain mapping and delineation required for the BESS Project as dictated by Law and in accordance with AHJ requirements for the Project Site.

2.6.5 Contractor is responsible for complying with all local fire codes and obtaining all relevant permits and inspections from the local fire department and AHJ relating to fire protection for the Project Site.

2.6.6 Contractor is responsible for applying for all erosion control, land disturbance, dust control, and stormwater permitting as required by each respective AHJ for the Project Site unless otherwise specified by the Owner.

2.7 Training

2.7.1 Contractor shall prepare and conduct comprehensive training for Owner and its operations and maintenance personnel in the safe operation and maintenance of the Project. Such training shall cover, at a minimum, the BESS, including the Collection System Circuits, BOP Equipment, fire protection systems, and the Communications System.

2.7.2 Contractor shall provide regular and ongoing lockout-tagout training to on-site personnel throughout the performance of the Work.

2.7.3 Contractor shall train personnel responsible for the operation, maintenance, repair, servicing, and response of the BESS in the procedures included in the Emergency Response Plan.

2.8 Temporary Facilities

2.8.1 At a minimum, Contractor shall furnish and install one single-wide office trailer for Owner’s exclusive use. The trailer shall be located at the laydown yard and shall be installed and ready-to-use no later than fourteen (14) Days after the Contractor mobilization date. Contractor shall be responsible for cleaning and maintaining the facilities until demobilization. Owner office trailer shall be demobilized no earlier than Substantial Completion.

2.8.2 Contractor shall supply, arrange, install, and pay for all other temporary facilities and utilities needed for the performance of Work. The Contractor shall be solely responsible, without increase in the contract price, to provide sufficient and appropriate first-aid facilities, sanitary facilities, and potable water for the benefit of all personnel performing the Work at the Project Site, and such facilities shall be maintained in a clean and orderly condition. Such facilities shall also be provided to support the work of any separate contractors engaged by the Owner.

(1) Contractor shall be responsible to determine and verify the adequacy and location of all existing utility services and capacities at its own expense prior to undertaking the Work.

2.8.3 Contractor shall be responsible for decommissioning and removal of the temporary sanitary facilities at the termination of construction and commissioning.

(1) Contractor shall maintain on-site dumpsters and personnel to maintain a clean and rubbish-free worksite. Contractor shall recycle any rubbish accepted by local recycling programs or as required by Project permitting requirements.

2.8.4 Contractor shall be responsible for designing and implementing temporary traffic control measures as required by applicable County or local agencies throughout construction duration for Contractor-provided Equipment and deliveries.

2.8.5 Contractor shall be responsible for establishing and maintaining temporary roads and parking areas for construction and office personnel. Temporary parking areas shall be returned to design grades and surfacing at the termination of construction.

2.9 Debris

2.9.1 Contractor shall assume ownership of all construction-related Unsuitable Material generated by Contractor, and any said material shall be removed from the Project Site and be properly disposed of by Contractor.

2.9.2 Contractor shall maintain a continuous and regular clean-up program to avoid accumulation of debris, waste, wreckage, and/or rubbish within the Project Site resulting from the Work and shall maintain the Project Site in a neat and orderly condition throughout the performance of the Work.

2.9.3 Contractor shall provide all trash and recycling collection, pickup, and removal related to the Work, including within Owner's office trailers and other temporary facilities, and including disposal of cable reels. Dumpsters and trash receptacles shall be provided in sufficient quantities and with sufficient volume to support timely trash removal from the Project Site and preclude windblown trash generated during construction activities. Dumpsters and trash receptacles shall be emptied at a reasonable frequency to prevent overflowing or accumulation of trash around the dumpster or receptacle.

2.9.4 Contractor shall maintain records of trash and recycling removal in accordance with any Project permitting requirements.

2.9.5 Contractor shall cause its Subcontractors, employees, and other representatives to refrain from littering at or within the Project Site, or within other areas (including along public roadways) used in conjunction with the Work.

2.9.6 Contractor shall use lined washout pits, washout dumpsters, or other suitable means to contain the excess concrete and runoff from the cleaning of concrete trucks. All washout waste shall be properly disposed of off the Project Site by Contractor in accordance with the Requirements.

2.9.7 Should any regulated waste (i.e., Hazardous Waste, Universal Waste, Petroleum Contaminated Soil, directional bore fluid waste etc.) be generated on-site, Contractor shall notify the Owner immediately. Any regulated waste shall be handled, stored, transported, and disposed of in accordance with all applicable regulations, and any documentation of these activities shall be provided to the Owner.

2.10 Logistics

2.10.1 Contractor shall furnish and deliver all Equipment to the Project Site. In the case of any Owner provided Equipment, Contractor shall coordinate with Owner or other entity procuring Equipment, such as the utility, on delivery to the Project Site.

2.10.2 Contractor shall perform all off-Project Site clearing necessary for the transportation of Contractor supplied Equipment to the Project Site, including, but not limited to, tree trimming/removal and clearing of overhead obstructions. As directed by Owner, Contractor shall also upgrade and maintain roads, bridges, and culverts within the project boundary for Contractor and Owner deliveries.

2.10.3 Contractor shall be responsible for designing and implementing temporary traffic control measures as required by applicable county or local agencies throughout construction duration.

2.11 Coordination

2.11.1 Contractor shall determine the sequence of Work necessary to meet all Agreement requirements. Refer to Attachment 2 (*Project Coordination and Meetings*) to this Exhibit for minimum project meeting requirements.

2.11.2 Contractor shall actively coordinate the sequence of Work for the Project Site with Owner, Supplier, and any other applicable manufacturers to support the Project Schedule. For the avoidance of doubt, this shall include coordination with the Contractor's schedule for the delivery and commissioning of the BESS. Contractor, Owner, and Supplier shall meet on a weekly basis before Equipment deliveries begin and as required by Owner after Equipment deliveries begin; the purpose of such meetings shall be to coordinate schedule for delivery and commissioning of the BESS. On a weekly basis, a meeting shall be held to reconcile all demurrage and delays for all parties regarding deliveries and offloading of components.

2.11.3 Contractor shall coordinate the completion of their activities with work performed by the Owner, any other contractors, and other entities, to facilitate proper installation and construction. This includes all requirements specified in each section of the Agreement.

(1) Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

(2) Coordinate installation of different components with other contractors to allow optimum accessibility for required maintenance, service, and repair.

(3) Make adequate provisions to accommodate items scheduled for later installation.

(4) Where availability of space is limited, coordinate installation of different components to allow optimum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

2.11.4 Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

(1) Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

2.11.5 Contractor shall coordinate with local utilities and pipeline companies to facilitate crossings requirements and interconnections necessary to perform the Work. For the avoidance of doubt, this shall include contacting local authorities, pipeline companies, and utility companies to locate conflicting underground facilities *prior* to starting any excavation or trenching Work.

2.11.6 Contractor shall be responsible for site security throughout construction duration until Substantial Completion, at which time Owner shall be responsible for site security.

2.11.7 Contractor shall provide traffic management as necessary to ensure safe site access from nearby public roads or easements for all vehicles and Equipment.

2.12 Project Sites Closeout and Restitution

2.12.1 Contractor shall remove all tools, equipment, surplus materials (including unused or useless materials), waste materials, temporary work (including temporary erosion control features), temporary buildings and facilities (including office trailers), and rubbish from the Project Site prior to Substantial Completion, and shall make any facilities used by Contractor during the performance of the Work to be restored to the same or better condition that such facilities and/or the Project Site were in on the date the Contractor commenced work at the Project Site, except for ordinary wear and tear.

2.12.2 Notwithstanding the following, all Work areas at the Project Site shall be restored, at a minimum, in accordance with the requirements set forth in the Applicable Permits, the SWPPP, and the other Requirements, as appropriate, and shall be fully restored to their pre-construction condition, at a minimum. Contractor shall perform restoration and/or reclamation of Work areas to include, but not limited to, the following:

(1) Clean all drains and ditches at completion of the construction Work, including removal of silt and debris from culverts, and leave the Project Site in a neat and presentable condition wherever construction operations have disturbed the conditions existing at the time of starting the Work.

(2) Preserve and/or restore to their pre-construction condition all land and impacted water resources.

(3) Re-dress all road surfaces within the Project Site such that the final cross section meets the specifications set forth in this Exhibit, all roadway surfaces are graded for draining and low spots are removed, and free of ruts, potholes, and damage.

(4) Seed all disturbed areas according to design drawings utilizing an approved seed mixture. Seeding shall occur during a time/season when the probability of successful seed germination is maximized; hydro-seeding is acceptable for slopes. Seeding shall conform to SWPPP requirements. Contractor is responsible for any additional seed applications as necessary to meet the requirements of the SWPPP restoration plan.

(5) Fill all depressions, ruts, and water pockets caused by construction operations and remove all obstructions within waterways.

(6) Spread surplus fill on Project Site in areas and depths approved by Owner.

(7) Spread recovered aggregate from laydown yard within approved disturbance limits at Owner-approved locations including but not limited to access roads.

(8) Collect large rocks or boulders unearthed during excavation as part of the Work but not utilized in the construction of the Project and Remove from site if an Owner-approved storage location at the Project Site is not identified.

3.0 CIVIL WORKS

3.1 General Provisions

3.1.1 This section covers the minimum scope and quality requirements for the plant civil design and construction.

3.1.2 Contractor is responsible for inspection, maintenance, and responsibility of the Project Site as a whole. The Contractor shall obtain any additional required geotechnical data, survey data, and drainage reports. Determine all Project Site data for the design and construction of the Project. It is Contractor's sole responsibility to ensure that the Work for the Project Site complies with all federal, state, and local code requirements and all applicable industry codes and standards, including standards of applicable AHJ for the Project.

3.1.3 The scope shall include:

(1) Design, prepare, and complete all construction plans, final design reports, and project specifications for the civil site work, including, but not limited to, the stormwater drainage, grading, roads, and temporary construction facilities required to construct the Project and meet AHJ criteria. Deliverables shall include, but are not limited to, the Engineering Deliverables List set forth in Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*). All shall meet the approvals of the Owner and jurisdictional government agencies.

(2) Construction of all civil site work, including but not limited to, the stormwater drainage infrastructure, earthwork, grading, roads, and security fencing.

(3) Construction of any temporary civil site work such as temporary security fencing, temporary construction roads, laydown areas, and parking areas to facilitate Project construction.

(4) Prepare and perform necessary environmental protection documentation such as Storm Water Pollution Prevention Plan (SWPPP) and Spill Prevention, Control, and Countermeasure (SPCC) to facilitate Project construction within local, state, and federal compliance.

(5) Perform flood management and stormwater pollution management during construction. Management shall be in compliance with standards of applicable AHJ for the Project including state and local sediment and erosion control rules, regulations, ordinances, and Owner-approved SWPPP.

(6) Perform dust control measures during construction in compliance with local, state, and federal rules, plans, regulations, permits and ordinances for fugitive dust emissions.

(7) Perform all construction surveys (construction staking, boundary, utility, and topographic, etc.).

(8) Prepare As-Built Drawings that depict any deviation from original design drawings.

(9) Prepare as-built survey during the course and completion of the Project.

(10) Perform hydraulic & hydrologic studies as required for design and local, state, and federal requirements. Studies shall be sealed by an engineer licensed in the State of the Project.

3.1.4 Project design shall consider existing site conditions with respect to soil characteristics, site clearing, grading, and drainage, as well as economic considerations. Contractor shall be responsible for all site preparation including any demolition, soil stabilization, grading, drainage, roadways, and temporary parking areas.

3.1.5 All permanent drainage facilities, including culverts, low-water crossings, ditches, and swales, shall be designed, and constructed to withstand a minimum 10-year, 24-hour storm event or local AHJ requirements.

3.1.6 Construction Surveys

(1) Contractor shall provide any additional boundary and topographical survey(s) required beyond what is provided by Owner for the design of the civil site work and temporary construction facilities. Survey of any applicable Right of Way (ROW) dedication or preparation of plats and legal descriptions are provided by Owner and shall be provided for use by Contractor as required.

(a) Contractor shall use NAD83 horizontal datum and NAVD88 vertical datum for all civil design drawings unless otherwise approved by Owner.

(b) Vertical and horizontal control shall originate from and tie into National Geodetic Survey (NGS) monuments or Owner approved locations.

(2) The Contractor shall take all necessary precautions to locate and protect all underground or overhead structures whether or not shown on survey. Locations of any identified existing underground or overhead utilities or structures are approximate in nature.

(3) The Contractor shall notify One-Call utility notification center (811) a minimum of three working days prior to any excavation or earthwork is performed.

(4) The Contractor shall field verify existing structures, utilities, and survey information and take necessary precautions during demolition and construction.

(5) Contractor is responsible for any misuse of the survey(s), and how the survey(s) is used for design and construction purposes.

(6) Contractor is responsible for the construction surveying and staking. All construction surveying and staking shall be performed under the supervision of a licensed surveyor in the jurisdiction of the Project. Environmentally sensitive areas shall be flagged in a different color than other flagging.

(7) Contractor shall furnish, install, and maintain temporary orange snow fencing or other Owner-approved delineation/marking method around all wetlands that are not permitted for temporary or permanent disturbance and archeologically-, culturally-, and environmentally sensitive areas at the Project Site, including those identified in the Applicable Permits. All temporary fencing shall be promptly replaced if it becomes deteriorated/unfit for purpose and removed prior to Contractor demobilization but not before Work in the applicable area(s) is completed.

(8) Contractor shall provide and maintain all surveying benchmarks, control points, and markings necessary to construct the Project and complete the Work throughout the duration of construction activities, to include, but not limited to:

(a) Grading limits.

(b) Limits of disturbance.

(c) Laydown and storage areas.

(d) Culturally, archeologically, and/or environmentally sensitive areas.

(e) Utilities, pipelines, and other buried facilities and their easements.

(f) Right of Way (ROW) dedication or preparation of plats and legal descriptions

(g) Access roads and crane paths and their easements.

(h) Collection System Circuit routing and their easements.

(i) Interconnection line routing, including centerline and structure locations.

(j) Battery Energy Storage System.

(9) Contractor shall be solely responsible for locating any survey monuments at or near the Project Site and shall replace such monuments by a licensed surveyor if they are disturbed during performance of the Work.

3.1.7 Fencing and Gates

(1) Contractor shall design, furnish, and install all fencing and gates as per Owner-provided design standards and specifications. Modify the Owner's design standards and specifications as necessary to account for frost depth per applicable Project geotechnical report recommendations or to account for other relevant project considerations that arise. Modifications shall be subject to Owner approval. All permanent fencing shall be appropriately grounded.

(2) Contractor shall install gate widths shall to be consistent with road widths, wherein all gate posts shall be set outside of the road width area. Sufficient space and graded area shall be provided near each gate to allow semi-tractor trailer to enter/exit the Project Site.

(a) Swing gates shall be provided at the BESS and Project Substation access road. Gate shall have two (2) leaves and shall be designed to swing out. Gate shall have 8'-0" chain link material topped by three (3) barb wires. Barb wire shall be installed in the plane of the gate. Provide gate stops and closed centering.

(3) Contractor shall install gates across fire apparatus access roads to be subject to AHJ approval and shall conform to local requirements for dimensions, securement means, and other code requirements.

3.1.8 Bollards

(1) Provide bollards as required for protection of Equipment and as required by building code of record and AHJ.

(2) Bollards shall comply with the following:

(a) Eighteen (18) inch diameter standard weight steel pipe.

(b) Extends three feet six inches (3'-6") feet above finish grade and is embedded six feet (6'-0") in concrete (minimum 2,000 psi) below finish grade.

(c) Painted safety yellow.

3.2 Submittals

3.2.1 Refer to Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*) for requirements.

3.3 Project Site Preparation

3.3.1 Contractor shall develop any stormwater management plans, site grading, civil/structural modifications, etc. necessary for the preparation of the site for Equipment installation.

3.3.2 Contractor shall develop and provide a site layout diagram/map (showing all major features of the proposed project, including access points) and all drawings, diagrams, and documents required for attainment of any/all permits required for the site preparation, and the installation and operation of the BESS system.

3.3.3 No construction activities shall be conducted within any Waters of the United States (WOTUS), as defined by the EPA and Army Corps of Engineers.

3.3.4 Construction activities shall follow state regulations and/or permit requirements within navigable and non-navigable waters as defined by the State of the Project.

3.3.5 Contractor shall provide all Project Site preparation as necessary to complete the Work, including, but not limited to, all clearing, grubbing, stripping, tree trimming, grading, compaction, demolition, blasting, excavation, soil stabilization, and drainage (temporary and permanent).

3.3.6 Site Clearing and Grubbing

(1) Contractor shall clear and grub all vegetation within areas where earthwork is to be performed. All vegetation and trees removed from the Project Site shall be disposed of by Contractor at a land fill or beneficial reuse facility.

(2) Burning of materials on-site is not allowed by Contractor unless authorized by AHJ in writing. On-site chipping and hauling is permissible by Contractor

(3) Contractor shall stockpile topsoil for later use during landscape reclamation activities. Topsoil shall be stockpiled on the property that it originated from (unless otherwise approved by Owner) and only in areas designated where it shall not interfere with construction operations or existing facilities. Stockpiled topsoil shall be reasonably free of subsoil, stumps, roots, debris, and stones larger than two (2) inches in diameter. Topsoil shall not be used as structural fill. Appropriate erosion control measures shall be utilized as per SWPPP and/or AHJ regulations.

(4) Root mats and stumps shall be completely removed from the Project Site's construction areas by the Contractor. Holes shall be refilled with select material and compacted adequately for the ultimate expected loading for the material used and graded to drain by the Contractor.

(5) Removal of or damage to trees beyond defined clearing limits by the Contractor is prohibited. Trees shall be adequately protected, including protecting tops, trunks, and roots of existing trees by the Contractor

(6) Certain trees or groups of trees within the clearing limits and may designate the trees to be preserved. The Contractor shall clearly mark trees or group of trees to be preserved within clearing limits. Contractor shall ensure damage does not occur to them.

(7) The Contractor shall obtain any and all haul permits, or other required permits and pay all associated fees including tipping fees.

3.3.7 Debris

(1) All construction-related Unsuitable Material including material from site clearing and grubbing, shall be removed from the premises and lawfully disposed of off-site by Contractor at Contractor's cost.

3.3.8 Stormwater Management and Erosion Control

(1) Contractor shall be responsible for installing and maintaining the stormwater controls and best management practices in compliance with the SWPPP.

(2) Contractor shall design site grading/drainage to prevent flooding and ponding within the Project Site. Project Site grading shall maintain slopes within the range of 0.5% to 2.0% to prevent on-site ponding. Ponding shall be limited to retention/detention ponds designed in accordance with applicable local, state, and federal requirements. Design should seek to minimize disturbance and maintain existing drainage patterns across the site. The civil drainage infrastructure design shall conform with the standard of the jurisdictional government agencies.

(3) Contractor shall construct site grading/drainage to minimize potential flooding and ponding on site. The working area of the site shall be well drained during and after construction.

(4) Contractor shall prepare drainage report(s) to support obtaining construction permits for the project, as applicable. The report(s) shall meet the standards and requirements of the AHJ.

(5) Contractor shall provide a design which meets the acceptance of Owner; such acceptance shall not be unreasonably withheld, which incorporates permanent, long-term measures which mitigate the flood potential associated with on-site generated stormwater runoff.

3.3.9 Road Maintenance

(1) All temporary access roadways used by Contractor, as well as the new site permanent roads shall be maintained in serviceable condition. Turnarounds shall be constructed where appropriate. Contractor shall keep the surfaces of those roadways free draining, free from spills, mounds, depressions, and obstructions, which might present a safety hazard or annoyance to traffic.

(2) Contractor shall be responsible for securing all authorization and permits to transport on local, county and state roads for the supply of materials under Contractor's scope including, but not limited to, oversized/overweight loads.

(3) Contractor shall document before/after conditions of local roads and private roads. Contractor is responsible for damage and wear to public roads and right-of-ways used to transport material and equipment to the Project Site. Damage and wear shall be repaired to the agreement / satisfaction of property owner or AHJ.

(4) Contractor shall supply and install any temporary or permanent facilities required to facilitate delivery of Contractor and Owner Equipment. Contractor shall also be responsible for removing all such temporary facilities.

(5) Contractor shall mitigate and remove sediment from public streets resulting from vehicular tracking dust control or vehicle spillage.

3.3.10 Dust Control for Construction Activities

(1) Contractor shall be responsible for dust control at the Project Site by preventing the spread of dust during its operations.

(a) Contractor shall furnish labor and Equipment necessary, or a suitable alternative with Owner's approval to apply the water or soil stabilizer as appropriate, to moisten all surfaces, to reduce the risk of dust becoming a nuisance.

(b) Contractor shall be responsible for compliance with all state and local requirements for fugitive dust emissions including all visibility limiting standards. Contractor shall obtain local authority approvals and/or activity permits and shall conform to the dust control regulations and reporting requirements. Contractor shall conform to all requirements of the Applicable Permits.

(c) Contractor shall monitor weather forecasts, and extreme wind forecasts. Weather and wind forecasts shall be considered when planning dust control level of effort and timing.

(2) Contractor shall be responsible for supplying, constructing, maintaining, and removing the temporary water supply which may be necessary to support construction. Contractor shall comply with Owner and AHJ requirements regarding how the water is supplied. Requirements may include limitations on the gallons per day usage, the time of day which the water may be drawn from the system, and restrictions on storing water in open/uncovered basins.

3.3.11 Earth Grading

(1) Contractor shall balance the earth grading and leave no stockpiles or pits remaining at the completion of the full build-out of the project. Stockpiling in accordance with applicable regulations may be permitted in support of phased construction. The grading design shall balance the earthwork to the greatest extent possible so that no major volumes of soils are imported or exported from the Project Site for grading purposes.

(2) Contractor is responsible to meet slopes, to provide smooth ground surfaces as necessary to support the BESS installation. The Contractor is responsible for any re-grading or repair costs associated with not providing ground surfaces which adequately support the BESS installation to the Owner's satisfaction and applicable Project manufacturer recommendations and equipment requirements.

3.3.12 Excavation, Filling, and Backfilling

(1) Excavated native material may be used on the site for embankment and backfill, if suitable. All Unsuitable Material such as rock, concrete, wood, metal, organics, and other materials from the excavation shall be considered debris and disposed of as described in this Exhibit.

(2) Structural fill, bedding material, topsoil thickness of 4" (or per Project geotechnical report recommendations), and other materials, if applicable and not readily available on site shall be procured, tested, and delivered to the site by the Contractor.

(3) Contractor shall be solely responsible for maintaining the stability of all excavated faces and shall provide adequate sheeting, shoring, and bracing to support any lateral earth pressure.

(4) Contractor shall perform excavations, sheeting, shoring, and temporary excavation support in accordance with OSHA 29CFR Part 1926, Subpart P, "Excavations".

(5) Contractor shall be solely responsible to protect personnel and adjacent structures against any damage from cave-ins, heaving or other earth movements. Sheeting, shoring, and bracing shall be removed as backfilling proceeds.

(6) Fill characteristics and compaction requirements shall be determined by Project geotechnical report recommendations.

(7) All Equipment used to meet compaction requirements shall be specifically designed for such duty.

3.3.13 All structure foundations shall be surveyed and staked prior to excavation. The methods of staking and final alignment shall be designed such that the finished condition of the Work meets the requirements for alignment, position, elevation, and rotation.

3.3.14 Contractor shall excavate and remove all rock as necessary to complete the Work, including any necessary blasting. Contractor shall notify Owner prior to the use of explosives at the Project Site; no blasting shall be performed without explicit written confirmation by Owner.

(1) When the use of explosives is necessary for the Work, Contractor shall use the utmost care not to endanger life or property and shall comply with all Applicable Laws and other Requirements and conduct the necessary advance notifications. All permits and licenses required for blasting shall be obtained, paid for, and maintained by Contractor.

(2) Owner shall be notified prior to the use of explosives at the Project Site, and such blasting shall be completed, at a minimum, in accordance with the Applicable Permits and Contractor-furnished blasting plan. Blasting shall be performed only by persons who are qualified, competent, and thoroughly experienced in the use of explosives for rock excavation. Blasting closer than 500 feet of utilities, pipelines, or facilities (buried or above-ground) shall be subject to approval of owning agency and Owner.

(3) Before delivery of any explosives to the Project Site, Contractor shall have obtained a blasting endorsement on their public liability and property damage insurance policy.

(4) All explosives shall be handled in a secure manner, and all such storage places (if permitted) shall be marked clearly “DANGER - EXPLOSIVES” or as otherwise required by law. Under no circumstance shall caps or other exploders or fuses be stored, transported, or kept together with powder.

(5) Blasted material shall be crushed and screened for use as fill on access roads and in other areas of the Project Site, assuming the aggregate meets the appropriate geotechnical specifications for this application. Contractor shall be responsible for verifying that the quantity and quality of such rock is suitable for use as aggregate at the Project Site.

(6) Excessive overbreak or damage to adjacent structures, exposed cut slopes, equipment, utilities, or buried pipeline and conduit shall be avoided. Charge holes shall be located properly and drilled to correct depths for charges used, and charges shall be limited in size to the minimum required for reasonable removal of material by excavating equipment. Blast mats shall be utilized as required in sensitive areas, including, but not limited to, archeologically sensitive areas, environmentally sensitive areas, existing Project Site facilities, and other Project infrastructure.

3.4 Site Improvements (Substation)

3.4.1 Duct Banks

(1) Underground banks of power and instrument conduit shall be encased in concrete.

(2) Encasements shall be reinforced to withstand AASHTO HS20 loading at way crossings and non-paved Equipment access areas susceptible to damage by cranes, trucks, etc.

(3) Concrete at the top of the duct bank shall be colored red.

3.4.2 Crushed Stone Surfacing

(1) Crushed rock surfacing within the Project Substation fence shall be 4 inches thick with a resistivity of 3000 ohmmeters.

(2) Crushed rock shall conform to ASTM C33, gradation 1-1/2 to No. 8 particles.

3.5 Site Roads

3.5.1 Site Access

(1) Access to the Project Site shall be constructed in accordance with applicable agency requirements, including, but not limited to the local fire department and AHJ.

(2) Contractor shall be responsible for obtaining and complying with all encroachment permits required to construct driveway aprons or otherwise connect access roads to publicly maintained roads, as applicable.

(3) Contractor shall furnish and install a gate at every location where a roadway penetrates a fence line at the Project Site. Unless explicitly noted otherwise, all gates shall comply with the applicable requirements in this Exhibit.

(4) Contractor shall maintain all public roads, access roads, and construction areas throughout the duration of the Work. Maintenance of such areas shall include washboard removal, pothole removal, snow removal, cleaning of silt and debris from culverts as necessary to facilitate drainage, dust control along access roads, and other similar items.

3.5.2 On-Site Roads

(1) Roads shall connect the Project access driveways to the main public roadway. On-site roadways shall be at a minimum 30 feet wide, or as required by locally adopted fire codes. Roadways shall be constructed in compliance with the recommendations of the geotechnical recommendations, unless supporting calculations by EOR show a different road section is viable or AHJ requires a different road width.

(2) Roadways shall be constructed to provide access to Equipment (including the Equipment by others) such that it is readily accessible for maintenance and operations. Turnarounds, hammer-head dead ends, intersection/radius improvements, and transitions to/from existing roads shall be designed in accordance with Applicable Standards and constructed as indicated in the Contractor-prepared civil works design. Roadway widths may vary depending on design, but design shall consider access requirements for operations and maintenance and AHJ requirements.

(3) Roadway design shall consider stormwater drainage and management in accordance with AHJ requirements.

(4) Roadways and driveways shall be designed for AASHTO HL-93 loading as a minimum. Laydown areas shall also be designed with consideration for concentrated loading due to handling of heavy loads.

(5) All interior roads shall provide all weather access.

3.5.3 All roads shall meet minimum requirements of local fire department or AHJ for the Project Site.

3.6 Public Roads

3.6.1 Contractor shall maintain all public roads used for access to the Project in their current condition.

3.6.2 Contractor shall maintain graveled public roads used throughout construction of the Project, including dust control, washboard removal, and pothole removal.

3.7 Drainage and Erosion Control

3.7.1 Contractor shall furnish, construct, install, and maintain all temporary and permanent erosion and sediment control measures and best management practices (BMPs) to minimize the erosion of embankments, temporary and final exposed slopes, and temporary stockpiles, all in conformance with the minimum requirements set forth in this Exhibit.

(1) Erosion and sediment control, both during and after construction, shall be provided as required by the Requirements and the Contractor-provided SWPPP to retain sediment onsite and to control the erosion of embankments, temporary and final exposed slopes, and temporary stockpiles, as well to protect water quality as applicable. Silt fences, check dams, drainage ditches or swales, straw mulch, and pre-manufactured geotextiles, geotubes, geogrids, cellular geoweb, and other similar items (collectively, the "best management practices," or "BMPs") shall be utilized as appropriate.

(2) Wetlands impacts shall be avoided to the maximum extent practicable and are subject to regulatory approval or other applicable Requirements.

(3) Toxic, or otherwise harmful erosion-control materials, shall not be used on or adjacent to the Project Site during the construction period. Erosion-control materials for BMPs, including but not limited to those listed above, shall comply with relevant ASTM/AASHTO standards, local DOT or equivalent standards and practices, and be subject to Owner, Engineer of Record, and applicable AHJ approval.

3.7.2 Contractor shall design, furnish, construct, and install drainage facilities in conformance with the minimum requirements set forth in this Exhibit.

(1) Working areas of the Project Site shall be well drained during and after construction, respectively. All drainage shall be away from buildings and foundations. Refer to Section 3.3.8 this Exhibit.

(2) Roadway cross sections shall be shaped to move water away from the road, such as crowning or cross-slopes, and roads shall be designed and constructed to prevent water ponding. Stormwater shall not channel flow across constructed roads.

(3) Sheet flows shall be collected and conveyed to culverts or channels to safely pass stormwater flows.

(4) All stormwater flows off the Project Site shall be returned to their original drainage patterns and the Project shall not increase flow rates from their historic levels.

(5) Culverts or low-water crossings shall be considered in areas where concentrated stormwater runs across Project Site roadways and accessways.

(6) Culvert ends, swales, and ditches shall be designed and constructed to control concentrated flow velocities and minimize erosion and siltation. Only culverts shall be used at entrances; low-water crossings are not allowed at entrances.

(7) Culverts shall be a minimum of 18" in diameter and constructed or manufactured of a corrosion-resistant material per the recommendations of the Project geotechnical report and other relevant studies. Corrosion-susceptible (e.g., bare, uncoated steel) culverts shall not be used in any case.

(8) Culverts and other/associated drainage components shall be approved by the Engineer of Record and certified as conforming to relevant ASTM/AASHTO standards. Mandrel deflection testing shall be required for any polyethylene or polypropylene pipe culverts in accordance with local DOT or equivalent standards, or subject to the approval of the Engineer of Record.

(9) Culvert cover requirements shall be as specified by the Engineer of Record or applicable AHJ requirements.

3.7.3 Contractor shall continuously monitor construction operations to avoid creating conditions that could lead to excessive erosion of soil with surface runoff from Work areas. Contractor shall furnish, construct, and install any necessary controls to protect water quality. The Notice of Intent (NOI) shall be filed by the Contractor. During restoration, the NOI shall be transferred to Owner at an agreed upon time so that Owner may file the Notice of Termination (NOT). The SWPPP is the Contractor's responsibility until NOT is accepted by the AHJ.

3.7.4 Contractor shall document and report any excessive erosion or adverse runoff events to the Owner and appropriate AHJ. Remediation and restoration efforts arising from such events are the sole responsibility of the Contractor. Contractor shall bear the cost of such efforts except where excessive erosion ore adverse runoff event could not reasonably have been foreseen or prevented by the Contractor's SWPPP protocols.

3.8 Testing and Quality Control

3.8.1 Contractor shall conduct quality control testing, in accordance with the following minimum requirements. All testing and sampling shall be performed by an independent, qualified, experienced third party as required by the Project building code in conformance with the minimum requirements set forth in this Exhibit and the Requirements.

3.8.2 Compaction and Roadway

(1) All roadways and compacted areas shall be tested to demonstrate they meet stated design criteria and recommendations of Project geotechnical report recommendations.

(2) Testing standards

(a) Maximum dry density and optimum moisture content per ASTM D698 or ASTM D1557 (as per geotechnical report recommendations).

(b) In-place density by nuclear methods (shallow) per ASTM D6938.Aggregate sampling per ASTM D75.

(c) Sieve analysis of fine and coarse aggregates per ASTM C136.

(d) Sand equivalent value per ASTM D2419.

(e) Liquid limit, plasticity limit, and plasticity index per ASTM D4318.

(3) Fill material/embankments

(a) Nuclear density testing shall be carried out within frequency, location, and lift thickness specified by the geotechnical report recommendations

(b) Grain size analysis, moisture content, Atterberg limits on fines contents, and standard proctor test on each material type.

(c) If proof roll fails, moisture density test at 4 per lift or every 1,000 feet of road, whichever is greater.

(d) Dynamic Cone Penetration (DCP) test at any location where moisture density testing fails. Civil Engineer of Record shall specify passing criteria for the DCP test (e.g., minimum blows per 6 inches).

(e) On compacted fine-grained soil subgrades, Contractor shall utilize the Static Cone Penetrometer (SCP) test to provide undrained shear strength.

(f) On compacted coarse-grained soil or cement-stabilized subgrades, contractor shall utilize the DCP to provide friction angle and CBR results.

(4) Compacted subgrade

(a) Proofroll over road and Project Site subgrade prior to placement of aggregate base. Proofrolling is not a substitute for nuclear density requirements recommended by the Geotechnical Report.

(b) Moisture density test every 100 feet per road lift.

(c) DCP test (recorded to a minimum depth of 2 feet) at any location where moisture density testing fails. Civil Engineer of Record shall specify passing criteria for the DCP test (e.g., minimum blows per 6 inches).

(5) Aggregate base

(a) Proof roll over entire length.

(b) DCP test (recorded to a minimum depth of 2 feet) every 1,000 feet or minimum 3 per road, whichever is greater.

(c) Sieve analysis, liquid limit, and plasticity index every 2,500 cubic yards.

(d) Wet ball mill or Los Angeles abrasion test, as applicable, every 5,000 cubic yards. Civil Engineer of Record shall specify passing criteria for the DCP test (e.g., minimum blows per 6 inches).

(6) Geosynthetics

(a) Geosynthetics used for stabilization, erosion control, drainage, or other purposes on the project site shall be certified to conform to relevant ASTM/AASHTO requirements and be installed according to local DOT or equivalent specifications and construction practices, or as specified or approved by the Engineer of Record.

3.8.3 Aggregates and fill incorporated into the Project or associated work, including construction-suitable non-organic native cut material from the Project site, shall be sampled and tested, and test results shall be submitted to and approved by Civil Engineer of Record and/or Owner prior to use.

(1) Sampling locations shall include, but not be limited to, aggregate sources, stockpiles, concrete and asphalt plants, on-site crushers, and point-of-placement.

(2) Properties tested shall include, but not be limited to, compaction characteristics, in-place density, gradation, fractured faces, deleterious materials, abrasion/wear, sulfate susceptibility/soundness, freeze-thaw/weathering durability, and flat and elongated particles. All testing shall be performed according to relevant local DOT or ASTM/AASHTO standards unless otherwise specified by Project Requirements, Civil Engineer of Record, Owner, or applicable AHJ.

(3) Wet Electrical Resistivity Testing of Aggregate (WERTA) is required for Crushed Rock Surfacing/Resistivity Rock, with minimum wet resistivity results of 3,000 ohm-meters when tested by methods approved by Owner or Civil Engineer of Record.

(4) Sampling and testing frequencies, methods, locations, and passing requirements shall be specified or agreed to in advance by the Civil Engineer of Record, Owner, or applicable AHJ.

(5) If approved by Owner and Civil Engineer of Record, aggregate source testing conducted and submitted as part of an approved sources program to State DOT in State of Project or State of Source for a pit/quarry/source in good standing may be an acceptable alternative to Contractor-provided source testing.

3.8.4 Refer to Section 4 of this Exhibit for concrete testing requirements.

3.8.5 If Asphaltic Pavements/Mixtures are required by the Project, Contractor shall furnish submittals including, but not limited to, asphalt mix designs, testing frequencies and quality control plan, cold weather paving plan, pavement marking plans, and traffic control plans. These shall be in accordance with local DOT or equivalent standards and subject to Engineer of Record, local AHJ, and Owner approval.

(1) Use of Asphaltic Pavements/Mixtures within the Project site shall be subject to the above requirements even in the case of small quantities (e.g., driveway aprons).

(2) Use of Asphaltic Pavements/Mixtures and associated pavement marking and traffic control outside of the Project site will meet or exceed the condition of existing roadways and shall be subject to the approval, agreement, supervision, and inspection of the local AHJ.

3.8.6 Other materials used for Civil Works on the Project site and incorporated into the work shall be certified to conform to relevant ASTM, AASHTO, or other equivalent applicable standards and be subject to approval by the Engineer of Record, Owner, and, as appropriate, applicable AHJ.

3.8.7 Contractor shall notify Owner of all testing schedules in advance of testing activities. Copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within fourteen (14) Days of completing such test.

4.0 STRUCTURAL WORKS

4.1 General Provisions

4.1.1 This section covers the minimum scope and quality requirements for the plant structural design and construction.

4.1.2 Contractor is responsible to inspect the Project Site, obtain any additional geotechnical data, and determine all Project Site data for the design and construction of the Project. This shall include determination of local code requirements for snow, seismic, and wind design loads. It is Contractor's sole responsibility to verify that the Work complies with the Agreement and the Requirements, including applicable AHJ standards and requirements for the Project.

4.1.3 The scope shall include:

(1) Design and prepare the construction plans, final design reports and calculations, and project specifications for the structural site work. Deliverables shall include but are not limited to the Engineering Deliverables List set forth in Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*). All shall meet the approvals of the Owner and jurisdictional government agencies.

(2) Construction of all structural site work, including but not limited to the foundations and any miscellaneous support structures.

(3) Prepare As-Built Drawings that depict any deviation from original design drawings.

4.1.4 Structures

(1) All buildings, support structures, foundations and equipment pads shall be constructed on competent materials as defined and determined by Project geotechnical report(s). All loose materials shall be removed from excavation bottoms. Unsatisfactory foundation subgrade material, as determined by the geotechnical engineer, shall be removed and replaced with compacted structural fill material or with suitable concrete fill.

(2) Foundation designs shall neglect or degrade soil strength properties at the top of the foundation as a result of frost or disturbance during installation per recommendations of the geotechnical engineer. All foundations shall be designed in accordance with the Project geotechnical report(s).

(3) All foundations and slabs-on-grade shall have a minimum projection (reveal) of six (6) inches above ground level. This may be decreased with Owner approval.

(4) All equipment pads shall be constructed to provide safe access to equipment cabinets and in accordance with the NEC working clearance requirements.

4.1.5 Concrete

(1) Structural concrete and non-structural concrete shall be in conformance with ACI 318, other ACI governing standards, and the building code of record for the Project.

(2) Concrete mix designs and concrete placement procedures shall be approved by Engineer of Record and Owner prior to use.

(3) If allowed by the Engineer of Record, fly ash or slag cement may be used as supplemental cementitious material in the concrete mix design. Fly ash may be used to replace up to a maximum of 25% of cementitious material content by mass. If used, fly ash shall be in accordance with ASTM C618 and shall be Class F; Class C fly ash shall not be used without Owner approval. Class C must have a maximum Calcium Oxide (CaO) content of 15% unless specific ASR testing is reported. Slag cement may be used to replace up to a maximum of 25% of cementitious material content by mass. If used, slag cement shall be used in accordance with ASTM C989 and shall be Grade 100 or 120.

(4) Cement and supplemental cementitious material sources and certificates of test shall be submitted to and approved by Engineer of Record and Owner prior to use.

(5) Mixing water shall be from a tested, potable water source or conform to the requirements of ASTM C94/C1602. Certificate of test or conformance shall be supplied to Engineer of Record and Owner prior to incorporating concrete into the work.

(a) Additional mixing water shall not be added to ready mix or other concrete following batching except either:

1. As required by mix design and delivery requirements that are reviewed and approved by the Engineer of Record and Owner in advance.

2. With the approval and under the direct supervision of the Owner or Engineer of Record’s Representative at the Project site.

(b) The addition of mixing water in transit or at the Project site must additionally meet the following conditions unless otherwise approved: (1) maximum allowable water-cement ratio is not exceeded; (2) maximum allowable slump is not exceeded; (3) maximum allowable mixing and agitating time (or drum revolutions) are not exceeded; (4) concrete is remixed for a minimum of 20 revolutions or at least half the minimum required mixing time or number of revolutions.

(c) Addition of mixing water at the sole discretion of the Contractor is not acceptable and shall be considered grounds for rejecting trucks/batches of concrete.

(6) Concrete placement shall not be permitted when weather conditions or other pertinent factors prevent proper placement and consolidation. Hot weather concreting shall be in accordance with ACI 305.1 and ACI 305R. Cold weather concreting shall be in accordance with ACI 306.1 and ACI 306R.

(7) All fins and other surface projections shall be removed from all formed surfaces.

(8) Exposed surfaces shall be cleaned and rubbed to produce a smooth, uniform surface that is free of marks, voids, surface glaze, and discoloration. Care shall be taken to see that all excess water is removed before making any finish.

(9) Unhardened concrete shall be protected from heavy rains, flowing water, excessive heat, or mechanical damage. Finished surfaces shall be protected from stains, abrasions, or physical damage.

(10) All concrete which is porous, honeycombed, or otherwise defective (including conditions which adversely affect durability, strength, and/or appearance) shall be repaired to the satisfaction of the Owner.

(11) Concrete admixtures, curing and sealing compounds, patching and repairing compounds, and other auxiliary concrete products and materials shall be certified to conform to relevant local DOT, ASTM, AASHTO, or other equivalent applicable standards and be subject to approval by the Engineer of Record and/or Owner. Application and dosage rates and methods shall conform to manufacturer recommendations unless otherwise approved by Engineer of Record.

4.1.6 Pre-packaged Grout

(1) Pre-packaged grout specifications and grouting plans/procedures shall be approved by Engineer of Record and Owner prior to use.

(2) Grouted surfaces that contain defects which adversely affect durability, strength, and/or appearance shall be repaired by a method approved by Owner or they shall be replaced.

4.1.7 Formwork

(1) Forms shall be substantial and sufficiently tight to prevent leakage and shall be properly supported and braced to maintain position and shape. Forms shall be designed to produce hardened concrete having the shape, lines, and dimensions indicated on the drawings, and forms for all exposed surfaces shall produce smooth, dense, and true finishes free of fins, imperfections, or other defects.

(2) Earth forms are not permitted.

(3) Commercial formulated form-releasing compounds shall not:

(a) Bond with, stain, or adversely affect concrete surfaces.

(b) Impair subsequent treatments of concrete surfaces requiring bond or adhesion.

(c) Impede wetting of surfaces to be cured with water or curing compound.

(4) Formwork for walls, columns, sides of beams, gravity structures, slabs-on-ground, and other vertical-type formwork not supporting the weight of concrete shall remain in place for at least 24 hours after concrete placement is completed. Forms for vertical surfaces must not be disturbed until the concrete can support its own weight and any loads. Formwork supporting weight of concrete and shoring shall not be removed until structural members have acquired sufficient strength to safely support their own weight and any construction or other superimposed loads to which the supported concrete may be subjected as determined by the Engineer or Record.

(5) Forms may be of wood, plywood, concrete-form-grade hardboard, metal, or other acceptable material, which shall produce smooth, true surfaces. Metal forms shall have smooth surfaces free from any pattern, irregularities, dents, or sags.

(6) Form ties shall be factory-fabricated, adjustable-length, removable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling concrete surfaces upon removal. For exposed concrete, provide ties so portion remaining within concrete after removal is at least 1.5 inches inside concrete. Form ties shall not leave holes larger than one (1) inch in diameter in concrete surfaces.

(7) Remove forms in a manner to avoid damage to the structure, with particular care for corners and edges.

4.1.8 Concrete Reinforcing Steel

(1) Welded wire reinforcement shall conform to ASTM A1064. Rolled fabric is not acceptable.

(2) Steel reinforcing bars shall conform to ASTM A615 Grade 60.

(3) At time of placing concrete, all reinforcing shall be free of loose rust, scale, oil, paint, mud, or other coatings which may destroy or reduce the concrete bond.

(4) All concrete reinforcing steel, including welded wire mesh and reinforcing bars, shall be accurately located, and held in position using proper reinforcement supports, spacers, and accessories in accordance with ACI MNL-66 "*Detailing Manual*" and CRSI's "*Manual of Standard Practice*".

(5) Where not otherwise specified, the minimum coverage of concrete over steel shall be in conformance with the building code of record and ACI 318.

(6) Concrete shall be placed at a consistent coverage thickness/depth over all rebar (e.g., all areas with a required minimum of three (3) inches of cover shall have a consistent thickness of 3 inches, without significant increases).

(7) Bolsters, Chairs, and Accessories:

(a) Conform to ACI MNL-66, CRSI Manual of Standard Practice, and CRSI-RB4.1.

(b) Metal accessories shall be galvanized or plastic-coated where legs are exposed in finished concrete surfaces.

(c) Do not use rocks, broken bricks, wood blocks, bare metal supports in contact with forms for exposed surfaces, or concrete fragments for support of concrete reinforcing steel.

4.1.9 Anchor Bolts

(1) Anchor Bolt Materials: Anchor bolts, nuts, washers and templates will be supplied and delivered to the site by the Purchaser, but the Contractor is responsible for unloading.

(2) Cast-in-place:

(a) Anchor bolts shall be properly located, accurately positioned, and maintained securely in place before placement of concrete. The threads on the upper end of each anchor bolt shall protrude sufficiently to satisfy the Requirements and adequately complete tensioning activities.

(b) Anchor bolts shall conform to ASTM F1554 grade 36 or weldable grade 55 and shall be hot-dip galvanized. Nuts shall be ASTM A563 Grade DH, and washers shall be ASTM F436.

(c) Furnish sizes, types, and quantity as required by the Equipment manufacturer and to transfer the necessary loads to the concrete.

(3) Post-installed:

(a) Furnish sizes, types, and quantity as required by the Equipment manufacturer and to transfer the necessary loads to the concrete.

(b) Furnish and install anchor type as applicable to equipment and exposure conditions.

(c) Installation shall conform to manufacturer's printed installation instructions.

(d) Post-installed anchors shall be designed per ACI 318 and qualified for cracked concrete per ACI 355.2 or ACI 355.4 with steel conforming to ASTM A36, ASTM A193, or ASTM F593

4.1.10 Structural Steel Fabrication and Connections

(1) Structural steel shall be fabricated and assembled in shop to the greatest extent possible. All structural steel shall conform to the following ASTM specifications:

(a) Wide Flange Shapes, Tees and Channels: ASTM A992 (50 ksi yield strength) or ASTM A572, Grade 50.

(b) Bars, Plates and Angles: ASTM A572, Grade 50.

(c) The use of ASTM A36 for plates or other structural members is subject to approval by the Owner. The Contractor may substitute steel of a higher strength grade than specified, subject to approval by the Owner and provided it meets all other design requirements.

(2) Design and fabrication shall be according to AISC 360 "Specification for Structural Steel Buildings", AISC 303 "Code of Standard Practice for Steel Buildings and Bridges", and AISC 341 "Seismic Provisions for Structural Steel Buildings" as applicable.

(3) Structural steel assemblies shall be completed, including welding of units, before starting galvanizing operations.

(4) High-strength bolts shall be installed according to the RCSC's "*Specification for Structural Joints Using High-Strength Bolts*" for type of bolt and type of joint specified.

(a) All bolted steel-to-steel connections shall be made using ASTM F3125, Grade A325, Type 1 high-strength bolts, unless approved by the Owner.

(b) All bolts, nuts and washers shall be hot-dip galvanized. Twist-off-type tension control (TC) bolt assemblies conforming to ASTM F3125 Grade F1852 may be used, subject to approval by the Owner.

(c) Connections designated as slip-critical ('SC') on the drawings shall be tensioned in accordance with RCSC specifications.

(5) Built-up sections shall be assembled and welded by methods that maintain true alignment of axes without exceeding tolerances of AISC's "*Code of Standard Practice for Steel Buildings and Bridges*" for mill material.

(6) Welded electrodes and connections shall comply with AWS D1.1 (and D1.8 seismic supplemental where applicable) for welding procedure specifications, tolerances, appearance, and quality of welds and for methods used in correcting welding Work.

(7) Zinc coating shall be applied by the hot-dip process to structural steel according to ASTM A123/A123M, ASTM A153, ASTM A384, and ASTM A385.

(8) All field welds, scratches and damaged galvanized surfaces shall be repaired by the Contractor. Affected areas shall be cleaned and coated with a zinc-rich paint in accordance with ASTM A780. The dry film thickness of the repaired area shall equal or exceed the original coating thickness.

4.2 Submittals

4.2.1 Refer to Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*) for requirements.

4.3 Structural Loading

4.3.1 Loads listed below shall be in accordance with the locally adopted versions of the building code of record for the Project and ASCE 7. If the local jurisdiction for the project has any additions or addenda to these codes, it is the Contractor's sole responsibility to determine local additions or addenda to verify that the Project complies with all federal, state, and local code requirements, including standards of applicable AHJ for the Project.

(1) Dead Loads

(a) Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including permanent hung loads.

(2) Live Loads

(a) Shall be determined in accordance with ASCE 7 and the local building code based on site-specific parameters.

(3) Snow Loads

(a) Shall be determined in accordance with ASCE 7 and the local building code based on site-specific parameters.

(4) Wind Loads

(a) Shall be determined in accordance with ASCE 7 and the local building code based on site-specific parameters.

(5) Seismic Loads

(a) Shall be determined in accordance with ASCE 7 and the local building code based on site-specific parameters.

(b) Soil profile type shall be determined by the Contractor based on the Project geotechnical report.

(6) Thermal Loads

(a) Buildings and structures shall be designed for forces and/or movements resulting from changes in temperature. Induced thermal loads (i.e., thermal loads induced by equipment operating temperatures) shall be considered in the design of applicable structural elements.

(7) Vehicular Traffic Loads

(a) Design loading, for areas accessible to vehicular traffic, shall be AASHTO HL-93.

(8) Soil and Hydrostatic Pressure Loads

(a) Earth pressure and hydrostatic pressure loads shall be based on the geotechnical conditions and groundwater levels at the Project Site. Seismic components shall be included as recommended by Project geotechnical report.

(9) Load Combinations

(a) Load combinations shall be in accordance with the locally adopted versions of the building code of record for the Project and ASCE 7. If the local jurisdiction for the project has any additions or addenda to these codes, it is the Contractor‘s sole responsibility to determine local additions or addenda to verify that the Project complies with all federal, state, and local code requirements, including standards of applicable AHJ for the Project.

4.4 Equipment Foundations

4.4.1 Contractor shall design, furnish, and install foundations as required for Equipment, in conformance with the minimum requirements set forth in this Exhibit.

(1) Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully functional, and safe Equipment foundation configuration.

(2) Equipment foundations shall, at a minimum, be designed using the final Project geotechnical report, including allowable soil bearing pressure values from soil borings at each specific equipment site/location and equipment loads provided by the equipment manufacturers.

(3) Foundation materials, including rebar, anchor bolts, forms, concrete, and grout, shall comply with the applicable structural requirements in this Exhibit.

(4) Contractor shall provide all necessary dewatering of the foundation excavation.

4.5 Corrosion Protection

4.5.1 Contractor shall design and specify corrosion protection systems as required to meet the project design life as specified in Section 2.0 of Exhibit B-1 (*Project Specific Information*).

(1) Submit any corrosion engineer's recommendations to the Owner for information and acceptance of the recommendations.

4.5.2 Stainless steel and galvanized steel shall not be painted.

4.6 Testing and Quality Control

4.6.1 Contractor shall conduct quality control testing, in accordance with the following minimum requirements. All testing shall be performed by an independent, experienced third party as required by the Project building code in conformance with the minimum requirements set forth in this Exhibit and the Requirements.

(1) Concrete

(a) Field testing and sampling shall be performed by an independent testing laboratory at Contractor's expense. Testing technician shall be an ACI Concrete Field Testing Technician Grade 1. Submit qualification records for field testing technicians prior to placing concrete.

(b) Concrete aggregate sampling and testing shall be performed by approved qualified technicians and independent testing laboratories at Contractor's expense according to the specifications of the Engineer of Record and the requirements of section 3.8 of this Exhibit.

(c) Compressive strength determinations and frequency of testing shall be in conformance with ACI 318 and applicable ASTM standards. Minimum 28-day compressive strengths and maximum water-cement (w/c) ratios shall be as follows:

Substation Foundations: 4,500 psi (0.45 max w/c ratio)
Interior Slabs-on-Grade: 4,000 psi (0.45 max w/c ratio)
Duct Banks: 3,000 psi (0.50 max w/c ratio)

(d) A set of six compression test cylinders shall be made each day concrete is placed. An additional set of three compression test cylinders shall be made for each additional 50 cubic yards of concrete placed in 1 day. One cylinder of each set shall be tested at an age of 3, 7 and, 14 days and two cylinders of each set shall be tested at an age of 28 days. The final cylinder will be kept as a spare for additional testing, if required.

(e) Field slump tests shall be performed in accordance with applicable ASTM standards. Construction tolerances on the specified slump ranges of up to +/- 1.5" may be allowed at the discretion of the Owner or Engineer of Record's Representative at the Project site. Slump of concrete used for substation, BESS, and other foundations shall be the following unless otherwise noted:

General Use (Mats, Footings): 3"-4"
Uncased Drilled Piers: 6"-7"
Drilled Piers (With Temporary Casing): 7"-8"
Duct Bank: 6"-7"

(f) Air content, concrete temperature, and ambient air temperature tests shall be performed in accordance with the requirements of the applicable ASTM standards. Test results shall be provided to Owner for records after test completion. In the event of failure of any aforementioned test, the Owner shall be notified.

1. Air content for all concrete shall be 6% ± 1.5%, except for interior slabs-on-grade, which shall be non-air-entrained (0%).

(g) Cold weather concreting and freeze-thaw protection shall be in accordance with ACI 306R. Concrete shall not be placed on frozen ground, and concrete materials shall be free from ice, snow, and frozen lumps. Adequate protection shall be provided to maintain concrete temperatures above 50°F for a minimum of seven days after placement.

(h) Do not remove or disturb formwork until the concrete has attained sufficient strength to safely support all dead loads and any imposed construction live loads (minimum 24 hours).

(i) Precast or prestressed concrete used in the Project shall be subject to the approval of the Engineer of Record and Owner. Precast or prestressed concrete components shall be subject to approved quality control production procedures, shop-inspected, and transported, handled, and constructed according to vendor requirements. Damage to precast components prior to Project commissioning and closeout shall be the sole responsibility of the Contractor. Repairs and repair means, methods, and materials shall be subject to approval by the Owner, Engineer of Record, and Vendor.

(2) Grout

(a) Grout test reports shall be provided to Owner after test completion. In the event of failure of any grout test, Owner shall be immediately notified, and a repair/remediation plan shall be provided.

(3) Structural steel

(a) Structural steel connections shall be inspected in accordance with AISC 360 Chapter N (and AISC 341 Chapter J where applicable) requirements. The Contractor is responsible for performing and paying for all inspections.

(b) Welding inspections shall be performed in accordance with AWS D1.1 (and D1.8 seismic supplemental where applicable).

1. Visual inspection of shop and field welds shall be performed by contractor’s certified welding inspector (CWI) in accordance with AWS QC1. The Owner reserves the right to perform independent visual or nondestructive testing (NDT) of any welds.

2. Nondestructive examination, such as magnetic particle or ultrasonic testing, is required for critical load-bearing welds when visual inspection indicates potential defects. Any welds failing to meet AWS D1.1 acceptance criteria shall be repaired and re-tested at Contractor's expense.

4.6.2 Contractor shall notify Owner of all testing schedules in advance of testing activities. Copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within fourteen (14) Days of completing such test.

4.6.3 Anchor bolt installation tolerances shall conform to ACI 117 unless more stringent requirements are specified by the equipment manufacturer.

4.6.4 In the absence of equipment vendor-specific settlement criteria, a maximum total settlement of 1.0 inch and a maximum differential settlement of 0.5 inch shall be assumed for design, unless otherwise confirmed by the Owner.

4.6.5 Pile installation shall conform to the placement tolerances specified in the table below:

ITEM	TOLERANCE
Horizontal location (width)	+/- 1/2"
Horizontal location (length)	+/- 1/2"
Twist about pile centerline	+/- 0.5 Degrees
Plumbness	+/- 1.5 Degrees
Top of pile elevation	+/- 1/2"
Top of cap plate elevation	+/- 1/8"

5.0 BATTERY ENERGY STORAGE SYSTEM (BESS)

5.1 General Provisions

5.1.1 Contractor shall design, furnish, and construct the BESS in accordance with the Agreement and the Requirements, including equipment manufacturer specific requirements.

5.1.2 Contractor shall coordinate with Owner and Supplier to identify all Equipment not fully assembled or installed that require field assembly by Contractor.

5.1.3 Contractor shall furnish all labor, Equipment, and Materials that are necessary for a complete, fully functional, and safe BESS.

5.1.4 Contractor shall coordinate with the Supplier to the extent to which Supplier furnishes and installs the AC and DC cabling and components. Contractor to furnish and install any AC and DC cabling and components not furnished and installed by the Supplier, unless otherwise specified or approved by Owner.

5.1.5 Access to the BESS shall be from existing roads or new access roads within the Project Site provided by Owner. Final BESS layout shall be designed by the Contractor, subject to Owner approval.

5.1.6 Furnish all Equipment and Materials necessary for BESS BOP installation in accordance with the Agreement and the Requirements.

5.1.7 All Work shall be designed to meet the requirements specified in this Exhibit.

5.1.8 Acceptable manufacturers are listed in Exhibit F (*Approved Manufacturers*). Alternative manufacturers are subject to Owner approval.

5.1.9 Equipment arrangement shall be as indicated on Contractor drawings. Working space, access aisleways, and means of egress shall comply with NEC and Life Safety Code, Owner requirements, and Equipment manufacturer requirements. Final Equipment arrangement shall be approved by Owner.

5.1.10 Lighting

(1) Contractor's site lighting design shall be compliant with the Applicable Standards for the Project Site.

(2) Contractor shall design and install lighting such that all light emanating from the facility must be contained on-site, within the site boundary, and directed towards the ground, using shielding as necessary.

(3) Contractor's site lighting design shall be compliant with the Illuminating Engineering Society (IES).

(4) Contractor's site lighting design shall provide illumination for equipment access, operations and maintenance, security, and egress as required by Applicable Standards, IES recommendations, AHJ requirements, Owner requirements, and Equipment manufacturer requirements.

(5) Size and install proper wire size, as required, such that the voltage drop from the power or lighting panel to the farthest luminaire or receptacle does not exceed 3%.

(6) Install all lighting circuits in field routed conduit systems.

5.1.11 Markers

(1) Cable marking tape shall be furnished and installed in trenches containing power cabling. Tape for electric power circuits shall be red, non-metallic, and detectable. Marking tape shall be placed 12 to 18 inches above cable. Communications and fiber optic facilities shall be identified in accordance with Owner requirements and applicable communications installation requirements.

(2) All crossings, including permanent road and utility crossings, shall be marked on each side using a cable marker.

(3) GPS-located marker balls shall be placed within all cable trench at all crossings (permanent road, pipeline, cable) and every Owner approved splice location.

(4) Where collection circuits cross right of ways, above-ground cable markers shall be Owner-approved markers, Pro-Mark PM303 or equivalent, and shall include a decal warning of buried cable and other Owner-approved details.

(5) All marker ball locations shall be recorded and included in final GIS-compatible as-built documentation.

5.1.12 Firestops

(1) Seal all conduit installed under the Agreement where terminated at cable trays, electrical equipment, or control equipment.

5.1.13 Miscellaneous Material

(1) Cable accessories, terminators, dead front load break and/or dead break elbows shall be designed and manufactured for the cable to be utilized, and rated for the Collection System Circuit voltage and application, suitable for outdoor use, and have an ampere rating not less than the associated circuit and equipment rating.

(2) Dead front, load break, and/or dead break elbows shall be supplied with test ports.

(3) Surge arresters shall be provided in accordance with Section 3, of Exhibit A-2 (Scope of Work (HV)) and applicable Owner standards.

(4) All MV cable stress cone terminations shall utilize NEMA 2-hole long barrel coated copper lugs certified for the use on the specific cable size. Where distribution type Y or T connections are used, standard lugs as supplied by the connection supplier are acceptable.

(5) If required, midspan grounding connections for medium-voltage cable shall utilize prefabricated cold-shrink type grounding kits by 3M, Raychem, or approved equivalent. Each midspan grounding location shall be located by GPS coordinates and identified with an RFID marker ball by 3M or approved equivalent. ID numbers shall be recorded on Collection System Circuit As-Built Drawings. The midspan ground kit shall be sized according to the short circuit level available at that point in the Collection System Circuit.

(6) All technicians installing cable accessories shall be trained by representatives from the manufacturing company and shall be documented to have passed this training by the manufacturer.

(7) Proper tools designed for the application, as approved by the MV accessory manufacturer and identified in the manufacturer's training, shall be utilized for MV cable preparation Failure to do so shall be grounds for rejection of the accessory installation.

5.2 Submittals

5.2.1 Refer to Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*).

5.2.2 Contractor shall prepare equipment specifications to define the requirements and properties for the procurement of all permanently installed Collection System Circuit Equipment and Materials. The specifications shall be submitted to Owner for review prior to the procurement of the applicable equipment. The following specifications shall be provided, as applicable to the Contractor's design:

5.2.3 Construction specification.

(1) Pad-mounted transformers.

(2) Switchboards/panelboards.

(3) Junction boxes.

(4) Power cable.

(5) Network/communications cable.

(6) Network/communications equipment.

(7) Fiber optic equipment.

(8) Handholes/enclosures.

5.2.4 Contractor shall submit manufacturer's approval drawings or product sheet (material cut sheets) for all permanently installed Collection System Circuit Equipment and Materials, including all items identified in Section 3, of Exhibit A-2 (*Scope of Work (HV)*) (, as well as splice kits, marker balls, fault detectors, surge arresters, patch panels, and elbows.

5.2.5 Contractor shall prepare a set of studies and analyses for the Project (collectively, the "**BESS Electrical Studies**") to demonstrate the adequacy of the proposed electrical system design, including any studies and analyses that may be necessary to ensure compliance with the Requirements, including the Applicable Standards or utility requirements. The BESS Electrical Studies shall be submitted to Owner for review *prior* to the procurement of the applicable Equipment. The following shall be included as part of the BESS Electrical Studies, at a minimum:

(1) Cable Ampacity Study: Load flow study with power flow analysis for the Collection System Circuits, including all medium-voltage cables and low-voltage cables (from the batteries to the POI). Final report shall include a table showing cable ampacity and percent loading per cable section corresponding to the Project one-line diagram. Cable ampacity shall not exceed the limit set forth in this Exhibit. All external heat sources shall be considered, including parallel circuits. Thermal design shall account for actual field soil samples and backfill requirements (native or engineered).

(2) Short Circuit Study: Short circuit analysis of Collection System Circuits and interconnection line, including secondary fault values for battery strings. The short circuit analysis and study shall be utilized in Contractor's electrical designs to support relay coordination study and Equipment specification.

(3) Load Flow Study: Analysis of the BESS electrical system to determine bus voltages, active and reactive power flow, equipment loading, cable loading, and system losses under normal operating conditions. The study shall be utilized to support the Contractor's electrical design and equipment specification.

(4) Concentric Induced Voltage Report: Analysis to calculate the maximum induced voltage on the Collection System Circuit shield wires.

(5) BESS Ground Grid Report: Analysis of BESS grounding design to verify the adequacy of the proposed design and the safety of personnel working in or around the BESS. The study shall confirm that the grounding system maintains touch and step voltages within tolerable limits, and shall be prepared in accordance with the procedures, data, and recommendations given in IEEE 80, as applicable. The study shall determine the ground potential rise with respect to remote earth, and foundations shall be modeled as they are actually constructed (i.e., if not solidly bonded (e.g., using wire ties), they should be modeled accordingly). The study shall consider clearing time in the event of a breaker failure for the purpose of determining if the grounding design (e.g., ground potential rise) is acceptable.

(6) Arc-Flash Hazard Calculation: Arc-flash hazard calculation for the DC BESS and the AC system including auxiliary power. This analysis shall be performed in accordance with the latest version of NFPA 70E and IEEE 1584. All Equipment calorie ratings shall be posted. All studies shall be performed in the SKM software.

(7) Voltage Drop Study: Analysis to determine the voltage drop that occurs along the power system ensuring that the voltage at the end of the lines is within acceptable limits.

(8) Harmonic Study: Analysis to determine the harmonic distortion that is present in the power system and verify efficiency requirements.

(9) Reactive Power Study: Analysis to determine the reactive power requirements of the power system.

(10) Insulation Coordination Study: Analysis to determine the insulation requirements for the equipment in the power system and ensure that the equipment is protected from overvoltage and other electrical stresses.

5.2.6 Contractor shall prepare energization plans and procedures for each Collection System Circuit. Energization plans shall be submitted to Owner for approval prior to use. Energization plans shall include both electrical and communications infrastructure as well as backfeed plans, soaking plans, testing plans, and lock out tag out procedures, at a minimum.

5.2.7 Contractor shall provide a complete recommended spare parts list for the Project's electrical works, including the Collection System Circuits. Such list shall include recommended quantities, part/model numbers, and nominal pricing.

5.2.8 Contractor shall prepare a set of drawings and analyses for the Project Site (collectively, the "Fire Protection Plans") to demonstrate the adequacy of the proposed fire protection system design, including any studies and analyses that may be necessary to ensure compliance with the Requirements. Contractor shall be responsible for coordinating with Owner and Supplier to clearly request documentation required to complete the Fire Protection Plans as described in this Exhibit. The Fire Protection Plans shall be submitted to Owner for review prior to the procurement of the applicable Equipment and any submissions to the AHJ. The following shall be included in the Fire Protection Plans, at a minimum:

(1) Fire Protection Design Basis Document: Contractor is responsible for assembling the fire protection design basis document, which formally defines the goals, objectives, and criteria for the acceptable level of fire protection for the site. The fire protection design basis document shall define the Applicable Standards, as well as the design rationale for the fire protection systems. Conceptual site layout drawings, wiring diagrams, equipment details, and controls matrix shall also be included.

(2) Fire Protection Construction Documents: Contractor is responsible for assembling all the plans, drawings, calculations, and specifications required by the AHJ for permit approval. Contractor shall coordinate with Supplier to develop a consolidated Fire Protection Construction Documents package consisting of the following:

(a) Location and layout diagram of the area in which the BESS is to be installed.

(b) Location and layout diagram of the area in which the BESS is to be installed.

(c) Details on hourly fire-resistant-rated assemblies provided or relied upon in relation to the BESS

(d) Quantities and types of BESS units.

(e) Manufacturer's specifications, ratings, and listings of BESS.

(f) Description of EMS and its operation.

(g) Location and content of required signage.

(h) Details on fire suppression, smoke or fire detection, gas detection, thermal management, ventilation, exhaust, and deflagration venting systems, if provided,

(i) Support arrangement associated with the installation, including any required seismic support.

(j) Large scale fire and explosion testing data and reports in accordance with UL 9540A as provided by Supplier.

(k) Calculations or modeling data to determine compliance with NFPA 68 and NFPA 69, as applicable.

(3) Hazard Mitigation Analysis (HMA): The hazard mitigation analysis shall evaluate the consequences of the following failure modes and others deemed necessary by the AHJ:

(a) A thermal runaway condition in a single BESS rack, module, or unit.

(b) Failure of any battery management system.

(c) Failure of any required ventilation or exhaust system.

(d) Voltage surges on the primary electric supply.

(e) Short circuits on the load side of the BESS.

(f) Failure of the smoke detection, fire detection, fire suppression, or gas detection system.

(g) Required spill neutralization not being provided or failure of a required secondary containment system.

(h) Failure of an energy storage management system or protection system that is not covered by the product listing FMEA.

(4) Emergency Response Plan (ERP): The emergency operations plan shall include the following:

(a) Procedures for safe shutdown, de-energizing, or isolation of equipment and systems under emergency conditions to reduce the risk of fire, electric shock, and personal injuries, and for safe start-up following cessation of emergency conditions.

(b) Procedures for inspection and testing of associated alarms, interlocks, and controls.

(c) Procedures to be followed in response to notifications of system alarms or out-of-range conditions that could signify potentially dangerous conditions, including shutting down equipment, summoning service or repair personnel, and providing agreed-upon notification to fire department personnel, if required.

(d) Emergency procedures to be followed in case of fire, explosion, release of liquids or vapors, damage to critical moving parts, or other potentially dangerous conditions.

(e) Response considerations similar to a safety data sheet (SDS) that address response safety concerns and extinguishment when an SDS is not required.

(f) Procedures for dealing with BESS equipment damaged in a fire or other emergency event, including contact information for personnel qualified to safely remove damaged BESS equipment from the facility.

(g) Other procedures as determined necessary by the AHJ to provide for the safety of occupants and emergency responders.

(h) Procedures and schedules for conducting drills of these procedures.

(5) Fire Protection Commissioning Plan: The commissioning plan shall include a description of the means and methods necessary to document and verify that the system and its associated controls and safety systems are in proper working condition. The commissioning plan shall include, but not be limited to the following:

(a) Overview of the commissioning process developed specifically for the BESS to be installed and narrative description of the activities to be conducted.

(b) Roles and responsibilities for all those involved in the design, commissioning, construction, installation, or operation of the system(s).

(c) List of the specific BESS and associated components, controls, and safety-related devices to be tested, a description of the tests to be performed and the functions to be tested.

(d) Plans and specifications necessary to understand the operation of the BESS and all associated operational controls and safety systems.

(e) Conditions under which all testing shall be performed. Testing conditions shall be representative of the conditions during normal operation of the system.

(f) Documentation of the Owner's Project requirements and the basis of design necessary to understand the installation and operation of the BESS.

(g) Verification that required equipment and systems are installed in accordance with the approved plans and specifications.

(h) Detailed description of each activity to be conducted during the commissioning process, who shall perform each activity, and at what point in time the activity is to be conducted.

(i) Procedures to be used in documenting the proper operation of the BESS and all associated operational controls and safety systems.

(j) Testing for any required fire detection or suppression and thermal management, ventilation, or exhaust systems associated with the installation and verification of proper operation of the safety controls.

(k) Commissioning checklist, relevant operational testing forms, necessary commissioning logs, and progress reports.

(l) Preparation and delivery of operation and maintenance documentation.

(m) Means and methods whereby facility operation and maintenance staff are trained on the system.

(n) Identification and documentation of the requirements for maintaining system performance to meet the original design intent during the operation phase.

(o) Identification of personnel who are qualified to service, maintain, and decommission the system and respond to incidents involving each system, including documentation that such service has been contracted for.

(6) UL 9540 Certification Plan: A written plan provided by a Nationally Recognized Testing Laboratory (NRTL) which defines the roles, responsibilities, tests, inspection points, and schedule associated with the UL 9540 field evaluation (if Supplier's solution does not receive a product listing). This plan shall be subject to AHJ and Owner approval.

(7) UL 9540 Certification: Where Supplier's solution is not a UL 9540 listed product, Contractor shall secure the services of an approved third-party certification organization or Nationally Recognized Testing Laboratory (NRTL) to conduct a UL 9540 field evaluation. BESS that are not listed in accordance with UL 9540 should be documented and verified as meeting the provisions of this standard. Contractor shall coordinate with Supplier to provide all inputs required by the certification organization for their field evaluation. Methodology of field evaluation and certification process shall be approved by AHJ and Owner.

5.3 Auxiliary Power

5.3.1 Auxiliary power shall be sourced as shown in Exhibit B-1 (*Project Specific Information and Preliminary Design).*

(1) Contractor shall coordinate with the Supplier to ensure that auxiliary voltage levels meet the requirements of the BESS Equipment as provided by Supplier.

5.3.2 Contractor shall provide external distribution Equipment to provide auxiliary power to the PBEs.

5.3.3 Auxiliary power shall be metered at the incoming line or main breaker of each piece of auxiliary power distribution equipment.

5.4 Batteries

5.4.1 Battery Usage

(1) See Section 5.0 of Exhibit B-1 (*Project Specific Information*) for planned use case for the BESS and equivalent cycles per year.

5.5 Site Fire Protection

5.5.1 Contractor shall be responsible for the design and installation of a fully functional, operational, and approved site fire protection and alarm system.

5.5.2 BESS Equipment shall be listed in accordance with Applicable Standards including but not limited to UL 9540, NFPA 855, IFC, other applicable local AHJ requirements, and as required by the approved HMA based on large scale fire testing performed in accordance with UL 9540A.

(1) Contractor shall provide the HMA to the Owner and AHJ for review and approval.

(2) Where there is a conflict between the codes and standards referenced above, the most restrictive shall govern unless otherwise approved by Owner.

5.5.3 Contractor shall be responsible for securing all permits, inspections, and approvals necessary for the completion of the site-wide fire detection and suppression system work, including payment of any associated fees. Contractor shall ensure individuals or entities who are performing design and installation of fire protection systems are licensed or approved to lawfully perform such functions.

5.5.4 Contractor shall coordinate with the Supplier to ensure that fire alarm and fire protection systems installed on-site meet the requirements of the BESS Equipment as provided by Supplier. All connections to and from Supplier's Equipment shall be in accordance with nationally recognized standards applicable to those systems, manufacturer's instructions, and equipment listings. At a minimum, Contractor shall be responsible for design and installation of the following:

(1) Battery PBE fire alarm panels shall be aggregated to a master fire alarm control panel or fire alarm network annunciator at a location approved by the Owner and AHJ in accordance with NFPA 72. The master fire alarm control panel or fire alarm network annunciator shall duplicate the alarms and trouble notifications of the enclosure fire alarm control panels.

(a) Fire alarm network shall be a Class A pathway designation in accordance with NFPA 72.

(b) Master fire alarm control panel and/or fire alarm network annunciator shall be installed in a NEMA 4 stainless steel enclosure with front access doors. Enclosure shall be provided with air conditioning and heaters to maintain conditions within acceptable fire alarm equipment operating conditions, if required. Enclosure shall be provided with an adjustable low temperature and high temperature supervisory monitoring device with Form C contacts, monitored by the fire alarm control panel.

(c) Location and information provided by master fire alarm control panel and/or fire alarm network annunciator shall be covered by the ERP and evaluated as part of the HMA.

(d) Emergency response personnel shall have the capability to evaluate alarm conditions and and the status of exhaust ventilation systems as required to exhaust accumulation of flammable gases in any battery PBE.

(e) Alarm signals from detection systems shall be transmitted to a supervising station in accordance with NFPA 72, unless otherwise approved by the AHJ and the Owner.

(2) If required by permitting or the AHJ, a permanent source of water for fire protection shall be provided in accordance with the locally adopted fire code and NFPA 855, unless otherwise approved by the Owner and AHJ. Where no permanent adequate and reliable water supply exists for fire protection purposes, NFPA 1142 is permitted to be used. Final design shall be approved by the Owner and AHJ. Water supply availability for fire protection shall be covered by the ERP and evaluated as part of the HMA.

(a) Accessible fire hydrants shall be provided for site BESS installations in accordance with the locally adopted fire code. Private fire service mains and their appurtenances shall be designed and installed in accordance with NFPA 24.

(b) If required, fire pumps shall be designed and installed in accordance with NFPA 20. If fire pumps are provided, fire pumps shall be sized and rated for the largest single fire water demand on the site. Fire pump enclosures shall be conditioned to maintain acceptable operating temperatures within the enclosure. Provide fire pumps, pump controllers, and all accessories. Test headers with flow measurement meters shall be provided at the fire pump enclosure to accommodate full flow test requirements and provide return to the fire water storage tank.

(c) If required, fire water storage tanks shall be designed and installed in accordance with NFPA 22. If fire water storage tanks are provided, the fire water storage tank shall be sized to store the required fire flow. The required fire flow shall be determined in accordance with the locally adopted fire code or other AHJ approved method but shall not be based on a fire flow duration of less than 2 hours.

(3) All fire protection equipment, materials, and components shall be UL listed and/or FM approved for fire protection service.

(4) A readily accessible means of electrically disconnecting for the BESS shall be provided.

5.6 Controls

5.6.1 Contractor shall supply, install, integrate, test, and commission complete BESS system, to include the purpose-built enclosures (PBEs), Power Conversion Systems (PCSs), and Energy Management System (EMS), and shall be responsible for engineering, procuring, and constructing the remaining facility systems. Remaining facility systems including, EMS and SCADA systems including, but are not limited to, the site controller, Power Plant Controller (PPC), RTU, DSM, BMS, PCS, HMI, routers, firewalls, switches, and other networking hardware, as required to provide a complete and functioning control system, capable of remote Automatic Generation Control (AGC) and local control of the BESS.

(1) EMS and associated equipment shall be located in an Owner-approved temperature-controlled building.

(2) SCADA equipment located in the BESS yard shall be in Owner-approved NEMA 4X enclosures.

(3) Supplementary equipment, necessary for network integration, such as fiber optic patch panels and fiber splice panels, installed within Owner-furnished purpose-built enclosures (PBEs), and Power Conversion Systems (PCSs), shall be approved by Owner.

5.6.2 Contractor shall be responsible for all communications infrastructure required for a compete and operational control system, including, but not limited to, network and communications cabling, patch panels, and splice enclosures.

5.7 Networking

5.7.1 Contractor shall furnish all labor, equipment, and materials that are necessary for a complete, fully functional, safe and secure network configuration.

5.7.2 Contractor shall furnish, install, and terminate all CAT6 Ethernet and Owner-approved fiber optic cabling between the field end control devices, such as battery racks, inverters, metering etc., and main network cabinet controllers, such as switches and firewalls; this includes fiber patch cables between fiber patch panels and devices and CAT6 RJ45 patch cables between devices and switches/firewalls/routers.

5.7.3 Network shall be designed with data continuity and reliability as priority.

5.7.4 Network shall be designed with redundancy so that there is no single point of failure to prevent control and monitoring of the BESS.

5.7.5 Network shall be designed to maintain a minimum of one (1) gigabit per second (Gbps) bandwidth throughout the backbone of the network.

5.7.6 Maximum propagation delay through the network shall be no greater than 500ms for control and 1 second for monitoring.

5.7.7 The network shall be compliant with all Applicable Standards, including NERC Functional Model Registered Entity function, NERC Reliability Standards, Regional Entity Standards, and approved regional variances. Further, the Communications System shall comply and be designed to work in accordance with applicable system operator approved protocols, operating guides, standards, business practice manuals, and/or approved rules. In so far as either a state utility commission or provincial authority has instituted additional regulations, the communications system shall be designed to accommodate where no conflict exists with NERC or FERC. Design shall include parameters for operating under conditions specified by requirements stated in this Exhibit, as well as capability to function on an evidentiary basis.

5.7.8 Network connected systems shall be segmented using network access controls such that only required communications for operation are permitted between devices.

5.7.9 Contractor shall provide wiring diagrams that show all network cabling

5.7.10 Security

(1) The network shall be designed per and adhere to any Owner required cybersecurity standards. Any exceptions shall be formally approved by Owner.

5.7.11 Network Cabling

(1) All communications cables, including fiber cables, shall be appropriately labeled with a permanently attached label at both ends. Labels shall be sequentially numbered and include both the "TO" and "FROM" terminations & locations.

(2) Fiber cable bend radius shall not exceed the manufacturer's requirements.

(3) Fiber system shall be designed for a minimum of five (5) dB system margin.

(4) Fiber system design shall be a fiber ring topology such that the system utilizes redundancy to prevent outages due to cable or equipment failures.

(5) Maximum attenuation of fiber cabling shall be:

(a) 0.35 dB/km at 1310 nm.

(b) 0.25 dB/km at 1550 nm.

(6) Fiber type multimode (OM1/2/3/4) or single mode (OS2) shall be submitted for Owner approval.

(7) All fiber shall use UPC connectors.

(8) Contractor shall provide 50% spares for fiber.

(9) Contractor shall terminate all spare fibers within a fiber patch panel sized to hold all fiber strands. In the case where a patch panel is not provided by vendor, Contractor shall provide a patch panel.

(10) CAT6 Ethernet cabling shall follow TIA-568 standard.

(11) Fiber optic and CAT6 ethernet cable may be installed in the same trench as the Collection System Circuit power cabling, as long as all cables are at the same burial depth and separated a minimum of 1-foot edge-to-edge from Collection System Circuit power cabling.

(12) When fiber and/or CAT6 Ethernet cables are installed in a trench, the fiber/Ethernet cable shall be placed in conduit or continuous innerduct, the cable shall be rated for underground use, and there shall be a suitable locating cable installed in the innerduct/conduit. Innerduct shall have a minimum diameter of 1.25 inches.

(13) All fiber cable used for point-to-point communications between two sites shall consist of a minimum of 24-strand multi/single mode or as otherwise required to maintain a minimum of at least one (1) gigabyte bandwidth throughout the backbone of the system.

(14) Fiber run between the Owner's network connection point and EMS shall be a minimum of 48-strand. All fiber shall be single-mode or multi-mode fiber, or as otherwise required to maintain a minimum of at least one (1) gigabyte bandwidth throughout the backbone of the system.

(15) Excess slack shall be provided to allow re-termination in the event of failure. Terminations shall be completed with either an approved communication cable pigtail kit or with approved mechanical connectors and an approved fanout kit. Electrical tape shall not be used to manage fiber optic cable slack.

(16) Conduits for fiber entry into the battery string areas shall include a pull string for pulling the cable.

(17) Fiber cables may be routed through Project Substation control cable trenches with other control wiring provided that a high-visibility color innerduct is used for identification and protection of the fiber cables.

(18) All fiber optic cable splice types and methods shall be subject to Owner approval.

5.7.12 Testing and Quality Control

(1) Contractor shall test, commission, start-up, and place into successful operation of the network, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall be in conformance with the following requirements:

(a) All personnel performing testing shall be trained and certified for all testing services provided. Proof of training shall be provided to Owner.

(b) All communications cables shall be tested by Contractor.

(c) All network equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

(d) All testing shall be performed as specified in the Applicable Standards.

(e) All testing shall be performed as reasonably recommended or required by the applicable Equipment suppliers.

(f) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(g) All fiber optic cable shall be visually inspected prior to installation/termination.

(h) Test every fiber strand on each fiber cable from termination to termination.

(i) Verify fiber optic system performance (power losses, splice, or connector losses, etc.) using OTDR. All such testing shall be done with an OTDR in both directions of the strands. Test results shall be less than the cable loss budget calculated in accordance with IEC 14763-3 using the individual values below.

1. For single mode fiber, test both directions at 1310 nm and 1550 nm. A successful test result shall be less than 0.35 dB/km at 1310 nm, and 0.25 dB/km at 1550 nm.

2. For multimode fiber, test both directions at 850 nm and 1300 nm. A successful test result shall be less than 3.0 dB/km at 850 nm, and 1.0 dB/km at 1300 nm.

3. Individual connector attenuation shall be less than 0.35 dB.

4. Individual strand, splice attenuation shall be less than 0.10 dB.

5. The averaged value of all splices in a single enclosure shall be less than 0.05 dB per location.

(j) Verify CAT6 ethernet system performance (power losses, splice, or connector losses, etc.) using a certified and calibrated twisted pair cable tester. Tester must have Level V accuracy in accordance with ANSI/TIA-1152A. Results criteria must be based on ANSI/TIA-568.2-D standards.

(k) All testing activities and results shall be documented and provided to Owner for review and acceptance at agreed-upon intervals during commissioning. Test results shall demonstrate compliance with applicable standards, manufacturer requirements, and project specifications.

5.8 Auxiliary Transformers

5.8.1 Sizes and ratings shall be as required per the Contractor's design.

5.8.2 Liquid-Filled Transformers

(1) Shall comply with the following latest standards:

(a) IEEE C57.12.00 - IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

(b) IEEE C57.12.10 - IEEE Standard Requirements for Liquid-Immersed Power Transformers.

(c) IEEE C57.12.34 - IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers.

(d) IEEE C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.

(e) NEMA CC 1 - Electric Power Connection for Substations.

(f) NEMA TR 1 - Transformers, Step Voltage Regulators and Reactors.

(2) Pad-mount transformers shall be fitted with in-line, medium-voltage rated, current-limiting fuse protection per phase utilizing suitably rated, oil-immersed, current-limiting fuses. The selection of these fuses shall be such as to ensure (a) compliance with the requirements of IEC 62655 or ANSI/IEEE equivalent; (b) short circuit protection of the MV transformer winding; (c) that degradation of the fuses does not occur as a result of the flow of repeated transformer magnetizing in-rush currents; and (d) ease of replacement following an in-service operation.

(a) Equivalent medium-voltage circuit breaker protection may be used in place of current-limiting fuse protection.

(3) Pad-mount transformers shall be fitted with a high-side disconnect with visible open with means to take an auxiliary transformer offline without taking an entire Collection System Circuit offline.

(4) Enclosure:

(a) Pad-mount transformer shall include a fully enclosed, transformer mounted, MV and LV termination, steel cabinet, suitable for outdoor installation, as per IEEE C57.12.28. The cabinet shall be so designed as to fully enclose all cable tails, cable terminations, grounding tags and transformer fittings within a tamper and rodent resistant, secure enclosure.

(b) Cabinet shall extend to floor level, fully shrouding all cable tails, having the facility for being directly bolted to the supporting pad.

(c) MV and LV compartments shall be partitioned such that access to each compartment is via a separate door. External access shall be available through the LV compartment door only, with access to the MV compartment door lock being available within the LV compartment. The doors shall be fitted with an all steel, robust, tamper-proof, three point (i.e., top, mid, and bottom) integral locking system. Each door shall have the capability of being securely locked shut via the application of a dedicated pad lock.

(d) Transformer nameplate and all transformer indication fittings (e.g., oil level indicator, oil temperature indicator) shall be located within the LV compartment, while all transformer operational fittings (e.g., tap changer switch, isolation switch etc.) shall be located within the MV compartment.

(e) Cabinet doors shall be fitted with anti-close stays designed such that both doors can be held open at right angles. The anti-close stay design shall be sufficiently strong enough to withstand the prevailing wind conditions.

(5) Percent impedance voltage shall be as indicated in Exhibit B (*Project Specific Information and Preliminary Design*), otherwise 5.75% ± 0.75%.

(6) Noise Level: Per NEMA Standards TR-1 (quote 55 dB as an option).

(7) Duty Cycle for energy storage application.

(8) Transformer shall be of the compartmental pad-mount design with dead front and loop feed features.

(9) Transformer kVA rating shall be selected to serve the downstream auxiliary power distribution equipment.

(10) Cooling class: KNAN or KNAF.

(11) Low voltage: As required for BESS auxiliary power system.

(12) High voltage: As specified in Section 5.0 of Exhibit B-1 (*Project Specific Information*).

(13) High efficiency: 99.2% or greater at nameplate output.

(14) No-Load losses shall be limited to 0.15% of full KVA rating.

(15) BIL ratings: To be stated in data sheet for Owner review.

(16) Winding insulation: 65ºC rise over 45ºC ambient.

(17) Number of windings: Maximum of three.

(18) De-energized tap changer with high voltage taps: two (2) 2.5% above and below nominal position, fully rated.

(19) Hook stick disconnect switch shall be located external to the transformer cabinet such that Arc Flash protection is not required for operation.

(20) Overcurrent and short circuit protection:

(a) Selected to provide protection for the auxiliary step-up transformer and all current carrying connections and conductors. Coordinated with the transformer damage curve to prevent damage.

(b) Provided with short circuit, interrupting, and close-and-latch capabilities according to the definitions of IEEE C37.04 – IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers, and meeting the requirements of IEEE C37.06 – IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis – Preferred Ratings and Related Required Capabilities for Voltages Above 1000V. Provide ratings equal to or greater than the maximum available fault current as determined by Supplier calculations and Contractor short circuit studies.

(c) May consist of one of the following:

1. Bayonet fuse (with holder) in series with partial range current limiting fuse, or

2. Internal expulsion fuse in series with oil immersed current limiting fuse, or

3. Electrically operated vacuum circuit breaker in a metal-clad construction according to the requirements of IEEE C37.20.2 – IEEE Standard for Metal-Clad Switchgear, or

4. Electrically operated load interrupter switch meeting the standards of IEEE C37.20.4 – IEEE Standard for Indoor AC Switches (1 kV to 38 kV) for use in Metal-Enclosed Switchgear and in a metal-clad construction according to the requirements of IEEE C37.20.2 with current limiting fuse provided for short circuit protection, or

5. Owner approved equal.

(21) Top powder coat of ANSI 70 light grey or other color as approved by Owner.

(22) Oil level, pressure/vacuum and oil temperature gauges. All instrumentation shall be read into SCADA. Oil temperature gauge to be furnished with two alarm contacts (warning and trip). Oil temperature and pressure transmitters shall provide binary outputs. Transformer shall have sudden pressure protection and associated output relay. Oil level gauge to be furnished with alarm contacts. Instrument gauges shall be located such that gauges can be read without requiring Arc Flash protection. Access to the Equipment shall be provided in accordance with NEC and OSHA standards.

(23) Drain valve with oil and dissolved gas analysis sampling provisions, readily accessible in normal operation. Valve shall be located external to the high voltage and low voltage compartments in a pad-lockable cover.

(24) NEMA 2-hole ground terminal pads.

(25) Transformer mounting pad design may be required to incorporate features for secondary containment of oil. Supplier shall conform to AHJ requirements and SPCC requirements, and design shall be reviewed and accepted by Owner.

(26) Transformer insulating/cooling liquid shall be non-hazardous and environmentally friendly such as FR3 or Owner approved equivalent.

(27) In addition to all routine factory testing per most recent standard of ANSI/IEEE standard C57.12.90 and C57.12.00, the following tests shall be conducted:

(a) Full ANSI impulse test on one (1) unit, preselected during production by Owner.

(b) Heat run test on one (1) unit, preselected during production by Owner.

5.8.3 Dry-Type Transformers

(1) Dry-type transformers shall comply with the following latest standards:

(a) IEEE C57.12.01 - General Requirements for Dry Type Transformers.

(b) IEEE C57.12.51 - Requirements for Ventilated Dry Type Power Transformers 501 kVA and Larger, Three-Phase, with High Voltage 601 to 34,500 Volts, Low Voltage 208Y/120 to 4160 Volts.

(c) IEEE C57.12.70 - Standard Terminal Markings and Connections for Distribution and Power Transformers.

(d) IEEE C57.12.80 - Terminology for Power and Distribution Transformers.

(e) IEEE C57.12.91 - Test Code for Dry Type Distribution and Power Transformers.

(f) IEEE C57.91 - Test Code for Dry Type Distribution and Power Transformers.

(g) IEEE C57.96 - Guide for Loading Dry Type Distribution and Power Transformers.

(h) NEMA CC 1 - Electric Power Connection for Substations.

(i) NEMA TR 1 - Transformers, Step Voltage Regulators and Reactors.

(2) Outdoor substation type.

(3) NEMA 3R, outdoor, ventilated dry type enclosed in steel housing with removable side panels having grilled openings backed with screen barriers.

(4) Windings shall be vacuum cast epoxy (Cast Coil) to eliminate all moisture and voids.

(a) Alternatively, the low-voltage winding may be made of resin impregnated insulating film (prepreg) with cast-resin encapsulated winding ends.

(5) Primary-Voltage Terminations:

(a) Power cable termination cabinet with hard bus terminations suitable for terminating the size and quantity of conductors required.

(6) Secondary-Voltage Terminations:

(a) Power cable termination cabinet with hard bus terminations suitable for terminating the size and quantity of conductors required.

(7) Power Cable Termination Cabinets:

(a) Contractor shall provide the transformer with the following:

1. Furnish a totally-enclosed, sidewall-mounted secondary voltage cabinet, with removable, gasketed, bolted-on front cover. Front cover shall include multiple sections to accommodate the PCS supplier's standard AC throat connection kit and allow access to secondary voltage bus.

2. Furnish a totally-enclosed, sidewall-mounted terminal primary-voltage cabinet, with removable, gasketed, bolted-on front cover and bottom. Bottom plate shall be removed by installing contractor and drilled for incoming conduits.

3. Primary-voltage cabinet shall be of sufficient size to permit proper termination of high-voltage shielded power cables with stress relief devices. Quantity of cables to be terminated on each hard bus termination shall be as specified.

4. Secondary-Voltage cabinet shall be of sufficient size to permit proper termination of 600 V insulated power cables. Quantity of cables to be terminated on each hard bus termination shall be as specified.

(b) Silver-plated or tin-plated spade type pads with two NEMA sized and spaced threaded holes.

(c) Provide a copper ground pad in each power cable termination cabinet for termination of cable shield drain wires and equipment ground conductors.

(d) Provide means of supporting cable so that cable shall not place excessive loads on the bushings.

(8) Core laminations to be "non-aging" cold-rolled, grain-oriented, highly permeable, silicon alloy steel.

(9) Transformers to be suitable for installation on concrete pad. Apply undercoating to all surfaces in contact with concrete.

(10) Vibration dampers between base and core-coil assembly.

(11) Porcelain or cast epoxy supports and spacers for coils, leads, terminals, and other live parts.

(12) Temperature alarm contacts and other circuits requiring external connections to be wired to properly labeled terminal blocks in a common junction box on the transformer.

(13) Provide engraved laminated plastic nameplates for each transformer and each instrument or control device mounted on the equipment.

(14) Include accessories as follows:

(a) Electronic temperature monitor with contacts for high-temperature alarm.

(b) Lifting lugs and jacking pads.

(c) Two ground pads, on diagonally opposite corners.

(d) All other standard accessories.

5.9 Cable

5.9.1 All Collection System Circuit power cabling within the BESS BOP scope shall be rated for the design voltages of the medium voltage and low voltage systems, type MV-105, three (3)-phase, 60 hertz, or Owner-approved equivalent.

(1) Collection System Circuits shall be of a discharge-free design and suitable for installation in conduit or duct, direct burial applications, and exposure to sunlight.

(2) Jacketed, single-conductor, appropriately sized, concentric neutral, insulated medium-voltage underground distribution power cable shall be used. All underground Collection System Circuit power cabling shall be supplied with a minimum of 100% insulation that meets or exceeds all requirements of applicable AEIC, IEEE, ICEA, NEMA, and UL standards. All Collection System Circuit cables shall be UL listed.

5.9.2 All DC power cabling shall be rated 2000 V, type RHH/RHW-2, or Owner-approved equivalent.

5.9.3 All LVAC power cabling shall be rated 600 V, type THHN/THWN-2, XHHW-2, RHH/RHW-2, USE-2, three (3)-phase, 60 hertz, or Owner-approved equivalent.

5.9.4 Cable ampacity shall not exceed the rated value, based on Project Site-specific thermal resistivities, soil temperature, and in consideration of all external heat sources. Ampacity shall be calculated based on thermal resistivity recommendations in the geotechnical report, as well as ambient soil temperature data obtained from the United States Department of Agriculture (USDA) weather stations located nearest to the Project Site. Ambient soil temperatures shall be determined using the average of the highest temperature recorded over the past five (5) years.

5.9.5 Notwithstanding the following sentence, all underground Collection System Circuit cabling shall be installed in conduit at a depth of at least 36 inches below grade. All crossings, including road and utility crossings, shall be installed in conduit and buried at a depth of at least 48 inches below grade.

5.9.6 A sufficient amount of cable slack shall be provided to allow installation of elbows and termination of the cables to the appropriate junction box terminals and permit ready disconnection of the elbows and mounting on the parking stands. For the avoidance of doubt, such slack shall allow for the installation/service disconnection of connectors, dead breaks, and other similar devices.

5.9.7 All Collection System Circuit power cabling shall be provided with terminators and labels. Labels shall be permanently attached at both ends. Labels shall be sequentially numbered and color-coded. The side nearest to substation shall have a single wrap phasing tape while side away from substation shall have a double wrap phasing tape.

5.9.8 Tapes shall be color coded depending on phase and voltage as follows:

(1) 120, 208, and 240 VAC: black for Phase A, red for Phase B, and blue for Phase C.

(2) 480 VAC: brown for Phase A, orange for Phase B, and yellow for Phase C.

(3) Medium voltage AC: black for Phase A, red for Phase B, and blue for Phase C.

(4) DC: red for positive (+) and black for negative (-).

(5) Neutrals: white or grey, according to NEC requirements.

(6) Grounds: bare, green, or green/yellow, according to NEC requirements.

5.9.9 Collection System Circuits shall be designed without the use of cable splices. If required and with Owner approval, underground splices shall be identified using GPS-located marker balls, and splices shall only be performed by a skilled, qualified craft worker who shall receive training at the Project Site from the splice kit manufacturer prior to performing splices; the coordinates of each splice shall be recorded and noted within the As-Built Drawings with distances indicated in the basic one-line drawing. Splicing of different cable types, splices between battery PBE, and “dutchman” cable splices are each strictly prohibited.

5.9.10 Low voltage cable splices, if used and approved by Owner, shall be completed in pull boxes or cabinets.

5.9.11 Excessive bending of cabling shall be avoided, and the manufacturer recommended bending radius shall not be exceeded.

5.9.12 Minimum Basic Insulation Level (BIL): based on voltage level, according to NEC requirements.

5.9.13 Maximum short circuit conductor temperature: 250°C.

5.10 Cable Trenches

5.10.1 All BESS cabling and circuits shall be installed via trenching; plowing and excavation by blasting for the BESS cabling and circuits is strictly prohibited unless approved by Owner. Trench widths shall be kept to a minimum to allow sufficient space for equipment installation. The trench bottom shall be firm for the entire length and width. Trenches shall be kept free from water. Conduit and cable shall not be placed on frozen ground.

5.10.2 Bedding and/or backfill material shall be installed around all buried BESS circuits to provide physical and/or thermal protection for buried cable. All trench bedding and/or backfill materials shall be screened and visually inspected for materials in excess of two (2) inches, with any backfill within 12 inches of cable being free of sharp objects, rocks, and other debris larger than 0.5 inches. All bedding and/or backfill material shall be composed of materials that are native to the Project Site. Such materials shall be free of debris, roots, organic matter, frozen matter, coal, ashes or cinders.

5.11 Junction Boxes

5.11.1 Junction boxes shall meet the requirements of IEEE C57.12.28, including water resistance.

5.11.2 Junction boxes shall be fiberglass. Painted steel junction boxes shall be approved by Owner.

5.11.3 Junction boxes shall not be installed in drive paths, and a minimum of 30” off the edge of drive paths.

5.11.4 Junction boxes shall utilize HS-20 rated junction box covers.

5.11.5 Junction boxes shall be lockable with a padlock.

5.11.6 Three phase underground fault indicators shall be provided at all above ground junction boxes. These indicators shall be SEL model with remote indicator installed to allow visibility from the nearest access road.

5.11.7 Junction boxes shall be installed level and plumb, and set on concrete with a rock base, with excavations filled with a minimum 2,000 psi slurry.

5.11.8 Junction boxes shall be clearly marked with an appropriate high-voltage sign identifying the junction box number and BESS cable, phasing, and circuit number.

5.11.9 Coordinates of each junction box shall be recorded and noted within the As-Built Drawings. Junction box locations shall be installed reasonably close to a roadway to facilitate access.

5.11.10 No medium-voltage cable run shall exceed 2,000 feet without a sectionalizing junction box.

5.12 Raceways

5.12.1 All above-ground power and communications cabling shall be installed in conduit or cable tray. All below grade crossings, including permanent road and utility crossings, shall be installed in conduit.

5.12.2 Conduit

(1) Contractor shall install all conduit, bends, accessories, fittings, junction boxes, mounting hardware, etc., as required to produce a complete system.

(2) Conduit shall be sized and installed in accordance with the NEC. Fabrication, testing, and installation shall be per NEMA TC-2.

(3) Threaded or compression fittings shall be used with all raceway types. Set-screw fittings are not permitted.

(4) Conduit size/fill ratio shall be in accordance with ANSI/NFPA 70, at a minimum.

(5) Location of all conduits shall be recorded within the As-Built Drawings.

(6) Non-metallic conduit shall be protected from sunlight with 10 mil tape or Owner-approved alternative.

(7) Interior surface of all conduits shall be smooth to prevent damage to the cables. When cable is pulled into a duct, a suitable pulling lubricant shall be used and bell housing installed on all conduit ends.

(8) Use suitable temporary plugs or caps to protect installed conduit against entrance of dirt, moisture, and debris.

(9) All conduit materials required shall be furnished new and undamaged in accordance with the following requirements, at a minimum:

(a) Duct: polyvinyl chloride, Schedule 80 PVC for sweeps and Schedule 40 PVC for underground applications in accordance with NEMA TC-2.

(b) Couplings: plastic, for use with duct previously specified and “Duct-to-steel” adapters as required, including joint cement.

(c) Spacers: plastic high impact, interlocking, base, and intermediate type.

(d) Factory bends and sweeps: Schedule 80 PVC or fiberglass, 3 foot minimum radius (or greater if required to not violate the minimum bending radius of the cable being installed in it).

(e) End bells: plastic.

(f) Plugs: plastic, high impact, tapered to fit end bell provided.

(g) Duct binder: hemp or sisal twine coupling.

5.12.3 Tray

(1) Tray shall be fabricated, tested, and installed per NEMA VE1, NEMA VE2, and the NEC.

(2) Aluminum: Straight section and fitting side rails and rungs shall be extruded from Aluminum Association Alloy 6063 and all fabricated parts shall be made from Aluminum Association Alloy 5052, in accordance with ASTM B221 and ANSI H35.1.

(3) Pre-galvanized Steel: Straight sections, fitting side rails, rungs, and covers shall be made from steel meeting the minimum mechanical properties and mill galvanized in accordance with ASTM A653 SS, Grade 33, coating designation G90.

(4) Hot-dip Galvanized Steel: Straight section and fitting side rails and rungs shall be made from steel meeting the minimum mechanical properties of ASTM A1011 SS, Grade 33 for 14 gauge and heavier, ASTM A1008, Grade 33, Type 2 for 16 gauge and lighter, and shall be hot-dip galvanized after fabrication in accordance with ASTM A123. All hot dip galvanized after fabrication cable trays and components shall be returned to point of manufacture after coating for inspection and removal of all icicles and excess zinc to mitigate damage to cables and/or injury to installers.

(5) Hardware shall be zinc plated in accordance with ASTM B633, SC1. If aluminum cable tray is to be used outdoors, then hardware shall be Type 316 stainless in accordance with ASTM F593 and F594.

5.13 Panelboards and Switchboards

5.13.1 Heavy-duty type with voltage and ampere ratings as indicated in Contractor's detailed design set.

5.13.2 NEMA 3R rated.

5.13.3 Panelboards shall be hot-dipped galvanized sheet metal boxes with code gage steel trim and finished with a rust inhibiting primer and light gray paint (formerly ANSI Z55.1.61 No. 61).

5.13.4 Switchboards shall be constructed of sheet steel for pad mounting and finished with a rust inhibiting primer and light gray paint (formerly ANSI Z55.1.61 No. 61).

5.13.5 Hinged door with lock and catch combination in the front trim of all panelboards.

5.13.6 Phenolic nameplate shall be on front of panel engraved with the panelboard or switchboard designation, and above each breaker operating handle on switchboards. The nameplate background shall be white and the nameplate letters shall be black.

5.13.7 Breakers with trip rating and number of poles as indicated in Contractor's detailed design set.

5.13.8 Future breaker space for the number of poles as indicated in Contractor's detailed design set.

5.13.9 Copper main buses with capacity as indicated in Contractor's detailed design set.

5.13.10 Short circuit current rating of the assembled panelboard or switchboard shall be determined by the Contractor, according to the short circuit study developed by the Contractor.

5.13.11 480VAC switchboards:

(1) Rated 600 VAC, 3 phase, 4 wire, solid neutral, with main breaker or lugs.

(2) Provide 100 ampere frame size bolt-on thermal-magnetic breakers with noninterchangeable trip units.

(3) Provide 225 ampere and larger frame size bolt-on thermal-magnetic breakers with interchangeable trip units.

5.13.12 120/208VAC panelboards:

(1) Rated 240 VAC, 3-phase, 4 wire, solid neutral, with main breaker or lugs as indicated.

(2) Provide 100 ampere frame size bolt-on thermal-magnetic breakers with noninterchangeable trip units.

(3) Breakers shall have a minimum interrupting capacity of 10,000 rms amperes symmetrical at 240 VAC.

5.14 Grounding

5.14.1 Except as otherwise indicated, provide electrical grounding and bonding systems necessary to comply with all Applicable Standards. Provide an assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type of component product meets indicated requirements, selection is Contractor's code-compliance option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications.

5.14.2 Contractor shall test the ground grid in accordance with the IEEE 81 Fall-Of-Potential method.

5.14.3 Grounding connections at junction boxes and pad-mount transformers shall be bolted to facilitate separation of grounds for continuity testing and ground mat testing.

5.14.4 Ground rods, if required by the grounding study, shall be segmented, copper-clad, 5/8 inch diameter, 10 foot long rods at a minimum.

5.14.5 All foundations shall be bonded to the site grounding system.

5.15 Surge Arresters

5.15.1 Surge arresters shall be provided at the end of each MV Collection System Circuit. Surge arresters shall be selected based on the output voltage of the PCS transformer, minimum 600 A, with a MCOV rating meeting the requirements of IEEE C62.11 for Station Class installation in a 60 hertz outdoor installation, unless a greater rating is required by the Contractor-provided transient overvoltage study. Surge arresters shall be direct connected.

5.15.2 Surge arresters shall provide overvoltage system protection in an insulated, fully shielded, submersible, dead-front device. Surge arresters shall be provided in pre-molded rubber elbows.

5.16 System Protection Requirements

5.16.1 Protection and coordination for the “plant-side” system including batteries, DC combiner panels, inverters, AC combiner panels, transformers, auxiliary systems, and switchgear (where applicable) shall adhere to IEEE 242.

5.16.2 A complete protective relaying system based on industry standards shall be a part of the AC system. The protective relaying and metering shall be integrated with the Project control system and communications channel to the SCADA system. However, integration into the Project control system shall not circumvent normal protective relaying functions.

(1) Separate and redundant meters shall be provided as required by Owner, utility, and Project control system requirements.

5.16.3 All protective equipment and schemes shall be properly coordinated with the protection of the utility substation where the Project is connected.

5.16.4 Contractor shall use microprocessor-type protection equipment.

5.16.5 Low-voltage buses and associated conductors shall be protected by appropriately coordinated overcurrent protection devices in accordance with the Contractor's protection and coordination study.

5.17 BESS Construction

5.17.1 Installation

(1) Offloading, storage, and erection of BESS Equipment shall be performed in accordance with the applicable instructions provided by the Supplier and the specifications provided herein, including critical lift plans.

(2) Mechanical Completion of battery PBE, including documentation of progress on Supplier-furnished forms if applicable, shall be successfully achieved in accordance with the instructions set forth in the installation manual and Mechanical Completion checklists provided by the Supplier.

(3) All rigging utilized for the transportation, offloading, or erection shall be rated, inspected daily, and load tested in accordance with Applicable Standards or other more rigorous requirements set forth in the HSSE Plan. Inspection reports shall be maintained at the Project Site and available for review by Owner.

(4) Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

(5) Contractor shall apply touch-up paint as necessary to repair any damage to BESS Equipment, including damage that occurred prior to or during BESS erection. Touch-up paint and method shall be approved by Equipment Supplier and Owner prior to repair.

(6) Contractor shall assemble, install, and erect the BESS, including all components, Equipment, transformers, and other similar items, and including furnishing of the main crane(s) with suitable capacity for BESS erection.

(a) Contractor shall furnish all labor, Equipment (including rigging, tooling, hoisting equipment, and lifting devices), and Materials that are necessary to assemble and install the BESS.

(7) Contractor shall furnish all labor, Equipment, and Materials that are necessary for the electrical connection of the BESS including the PBEs, inverters, MV transformers, and the Collection System Circuits to the Project Substation.

(8) Contractor shall install the grounding system for the BESS.

(9) BESS should be reasonably clean and free from grease, oil, and other deleterious materials prior to Mechanical Completion.

(10) Contractor shall provide qualified personnel to perform lock-out/tag-out, switching, and other similar activities during the commissioning of the BESS up until Substantial Completion.

5.17.2 Coordination

(1) Contractor shall actively coordinate the sequence of Work with Owner and Subcontractors to support the Project Schedule.

(2) Contractor shall coordinate with Supplier on the handoff following BESS Mechanical Completion. At a minimum, such coordination shall ensure that Supplier is aware that the respective BESS has successfully completed Mechanical Completion so that Supplier may commence inspection and commissioning activities.

(3) Contractor shall attend and actively participate in all BESS Mechanical Completion walk-downs with Supplier.

(4) Contractor shall provide qualified support personnel to perform all lock-out-tag-out, switching, startup and testing activities in connection with Supplier's commissioning, start-up and testing of the BESS.

(5) Contractor shall coordinate with Supplier on any termination of power or communication cabling in the BESS following Mechanical Completion.

5.18 Commissioning

5.18.1 Contractor shall test, commission, start-up, and place into successful operation the BESS, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall be in conformance with the requirements defined in this Exhibit.

5.18.2 Contractor shall develop a testing plan and execute tests to verify Mechanical Completion of all installed Equipment. Plan shall be agreed upon by the Owner sixty (60) Days prior to execution.

5.18.3 Contractor shall coordinate with the Supplier to determine what additional checklist items are required to achieve Mechanical Completion, commissioning, and energization.

5.18.4 Requirements for the BESS functional testing include but are not limited to:

(1) Contractor shall ensure fire protection system acceptance testing and commissioning has been performed in accordance with the approved acceptance test plan.

(a) Flush, test, and commission water supply system as required by the applicable design and installation standard.

(b) Test and commission the fire alarm system including devices within battery PBEs. Upon successful completion of acceptance tests, submit a final "Record of Completion" and "Inspection and Testing Form" as required by NFPA 72.

(c) Test and commission the explosion protection system(s). Upon successful completion submit a final commissioning form.

(2) Contractor shall verify proper meter operation and installation per Equipment manufacturer specifications. When open loop control is used, power losses from PCS terminals to the site meter at the medium or high voltage point, due to transformer losses, should be compensated by this calibration.

(a) Verify proper wiring and installation per manufacturer specifications and/or design documents.

(b) Verify proper current and voltage transformer (CT/VT) selection based on required accuracy classification.

(c) Verify CT current readings are all the same to confirm orientation.

(d) Verify proper CT & VT ratio programming into meter.

(e) Verify meter date and time are linked to GPS clock.

(f) Verify meter is accurately capturing and recording performance data.

(g) Verify meter is properly communicating with EMS/SCADA system.

(3) Contractor shall perform insulation tests for all installed conductors and provide certifications for test equipment used.

(a) Contractor shall perform Very Low Frequency (VLF) withstand testing in accordance with IEEE 400.2, Table 3, VLF Withstand Test Voltages for Sinusoidal and Cosine-Rectangular Waveforms.

1. Voltages shall be in accordance with IEEE 400.2 for new cables.

2. Duration of the VLF withstand test shall be one hour per IEEE 400.2 for new cables.

3. Disconnect from all equipment during testing. Perform tests after installation, but before final connection to equipment. Testing cable on the reel shall not be used for final acceptance.

(4) Contractor shall verify all applicable Equipment installed is torqued per approved design documents and manufacturer requirements.

(5) Contractor shall verify all Equipment is installed and spaced per approved plans and appropriate installation manuals, including verifying minimum spacing and clearances as specified by Equipment manufacturers.

(6) Contractor shall verify all Equipment is properly labeled.

(7) Contractor shall verify all conductors are in the correct phase rotation indicated by final electrical design plans.

(8) Contractor shall test and verify all communications and controls cables and equipment, including networking and routing.

5.19 Substantial Completion

5.19.1 The following are conditions required to achieve Contractor Substantial Completion.

(1) All requirements of Mechanical Completion have been completed to the satisfaction of the Owner.

(2) Successful completion of functional testing of the BESS system as defined in Section 5.18.4.

(3) All Contractor submittals have been received and approved to Owner's satisfaction.

(4) Contractor has delivered all applicable lien waivers to Owner.

ATTACHMENT 1 TO EXHIBIT A-1

CONTRACTOR PROJECT SCHEDULE REQUIREMENTS

Without limiting the information summarized herein, the purpose of this attachment is to summarize the minimum contents and requirements for the Contractor-prepared Project Schedule. Contractor shall prepare and maintain Project Schedule for the Project Site.

A. Definitions

1. For purposes of only this Attachment 1, the following words shall have the respective meanings set forth below:

   a. "**Activity**" means a discrete part of a contract that can be identified for planning, scheduling, monitoring, and controlling the construction work. Activities included in a construction schedule consume time and resources but shall not include planned work stoppages. Activities shall not normally reflect the Work of more than one trade.

   b. "**Baseline schedule**" means the initial Project Schedule, as approved by Owner.

   c. "**Critical path**" means the longest sequence of activities in a project plan which shall be completed on time for that project to be completed by the stated due date.

   d. "**Critical path method**" or "**CPM**" means a method of planning and scheduling a construction contract where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Agreement.

   e. "**Float**" means the measure of leeway in starting and completing an activity. Float time (including total float) is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resources available to both parties as needed to meet schedule milestones and Agreement completion date.

   f. "**Predecessor activity**" means an activity that precedes another activity in the network.

   g. "**Resource loading**" means the allocation of manpower, equipment, or material necessary for the completion of an activity as scheduled.

   h. "**Successor activity**" means an activity that follows another activity in the network.

   i. "**Total float**" means the measure of leeway in starting or completing an activity without adversely affecting an intermediate deadline or the planned Agreement completion date.

B. General Requirements

1. Contractor's accepted baseline schedule shall be provided by the Contractor and set forth as Exhibit A-6 (*Contractor Baseline Schedule*).

2. Contractor shall utilize a professional project management software for preparation of the Project Schedule.

3. Activities in the Project Schedule shall be defined so that no single construction activity is longer than twenty (20) Working Days, unless specifically allowed by Owner.

4. Project Schedule shall include a clear and logical work breakdown structure, wherein all items are assigned a sensible activity number based upon the type of work being performed. Activity numbering shall be such that predecessor activity numbers are smaller numerically than successor activity numbers in the baseline schedule. No activity number shall change after approval of the baseline schedule.

5. Procurement process activities shall be included for all long-lead and major items (as defined by Owner) as separate activities in the Project Schedule. Procurement cycle activities shall include, at a minimum, submittals, approvals, purchasing, fabrication, and delivery.

6. Project Schedule shall indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Preparation and processing of submittals.

    b. Mobilization and demobilization.

    c. Acquisition of key permits.

    d. Installation.

    e. Utility interruptions.

    f. Tests and inspections.

    g. Startup and initial operations.

    h. Work by Owner that may affect or be affected by Contractor’s activities.

    i. Training.

7. Project Schedule shall include milestones indicated in the Agreement. All major milestones shall be presented at the top of the Project Schedule.

8. Project Schedule shall show the Work in Gantt chart format, on a sheet size of 11 inch by 17 inch; the scale and spacing shall allow room for notation and revisions, and the font shall be sized such that it is easily legible when printed.

9. Each revised or updated Project Schedule shall show actual progress compared to the originally accepted baseline schedule, or mutually agreed upon baseline schedule, and any proposed changes in the schedule of remaining Work.

10. Project Schedule shall clearly identify all critical path activities. Scheduled start and completion dates shall be consistent with Agreement milestone dates.

11. All activities shall have a predecessor activity and successor activity except for the first and last activities in the Project Schedule.

12. Project Schedule shall meet the minimum requirements for submittals set forth in Exhibit C-1 (*Contractor Deliverables*) and Exhibit C-2 (*Submittal Schedule*).

13. Project Schedule shall include allowances for delays that may be encountered for reasonably expected weather conditions, non-working holidays, and other similar items. Contractor and Owner shall agree to weather delays, non-working holidays, and other schedule allowances included in the schedule.

C. Concurrent with each Project Schedule submittal, Contractor shall submit the following reports:

1. General: electronic copies of the complete Project Schedule file in an approved scheduling software by the owner. Electronic copy format shall be in native format as approved by Owner and .pdf format, respectively.

2. Critical path report: list of all activities on critical path, sorted in ascending order by activity number.

3. Activity report: list of all in-process activities sorted by activity number or actual start date. Within each activity, Contractor shall indicate estimated completion percentage.

4. Three-week look ahead: list of all planned and in-process Work activities during the current week and the subsequent three-week interval, sorted in ascending order by activity number.

5. Completed Activities Report: A list of all activities completed during the previous week, including their actual finish dates and all successor activities.

6. Schedule Variance Report: report showing the variance between the current Project Schedule submittal and the previous period's Project Schedule submittal illustrating changes to the following for each milestone and activity:

a. Total float.

b. Total duration.

c. Added or deleted activities.

d. Critical path chain.

e. Previous period variance to planned start & planned finish

f. Contractor shall provide a schedule change narrative, less than one page in length, describing the necessity and rationale for the changes to the schedule in the previous period.

D. Recovery Schedule

1. Contractor shall notify Owner of any delay or potential delay to progress that would cause the Contractor to deviate from the critical path. This delay shall be discussed with the Owner and if a recovery plan is deemed necessary the contractor shall submit a recovery plan within the owner's approved period. The recovery plan shall be in the form of a schedule update that displays the details required to get the Project Schedule back to the approved critical path dates in the baseline schedule.

ATTACHMENT 2 TO EXHIBIT A-1

PROJECT COORDINATION AND MEETINGS

A. Contractor shall coordinate the completion of their activities with Work performed by the Owner, Supplier, other contractors, and other entities, to facilitate proper installation and construction. This includes all requirements specified in each section of the Agreement.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2. Coordinate installation of different components with other contractors to allow optimum accessibility for required maintenance, service, and repair.

3. Make adequate provisions to accommodate items scheduled for later installation.

4. Where availability of space is limited, coordinate installation of different components to allow optimum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Preconstruction Meeting

1. Contractor shall conduct a meeting within thirty (30) Days after the FNTP, to review items stated in the meeting agenda and to establish a working understanding between the parties as to their relationships during performance of the Work.

2. Preconstruction Meeting shall be attended by:

a. Representative(s) of Contractor.

b. Owner’s Representative(s).

c. At Owner's option, representatives of principal Subcontractors and Supplier.

3. Meeting agenda:

a. Construction schedules.

b. Phasing.

c. Critical Work sequencing and long-lead items.

d. Designation of key personnel and their duties; lines of communication.

e. Project coordination.

f. Procedures and processing of:

(1) RFIs.

(2) Field decisions.

(3) Substitutions.

(4) Submittals.

(5) Change Orders.

(6) Applications for Payment.

g. Procedures for testing.

h. Procedures for preparing and maintaining record documents.

i. Use of premises:

(1) Office, work, storage, laydown, and parking areas.

(2) Owner's requirements.

(3) Work restrictions and hours.

j. Construction facilities, controls, and construction aids.

k. Temporary utilities.

l. Safety and first aid.

m. Security.

n. Deliveries of Equipment and Materials.

4. Location of meeting:

a. To be determined, Contractor shall prepare for on-site meeting location based on Project Site amenities at time of meeting.

5. Reporting:

a. Within three (3) Business Days after the meeting, Contractor shall prepare and distribute minutes of the meeting to Owner and Owner’s Representatives.

b. Contractor shall provide copies to subcontractors and Supplier.

D. Construction Progress Meetings

1. Contractor shall schedule and conduct a meeting at least weekly and at other times requested by Owner. Owner's Representatives and Contractor shall be present at each meeting. Contractor may request attendance by representatives of subcontractors, Supplier, or other entities concerned with current program or involved with planning, coordination, or performance of future activities. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

2. Contractor and each Subcontractor represented shall be prepared to discuss the current construction progress report and any anticipated future changes to the schedule. Each Subcontractor shall comment on the schedules of Contractor and other subcontractors and advise if their current progress or anticipated activities are compatible with that Subcontractor's Work.

    a. Within the progress report, major quantities shall be tracked on a weekly basis through an Owner-approved method and format. Progress shall be measured using predetermined and Owner agreed upon claiming schemes. The progress report shall contain installed quantities and craft-hours spent for each reporting period.

3. If one Subcontractor is delaying another, the Contractor shall issue a notice of delay to the Owner and the Subcontractor as soon as the delay is identified. Such directions are necessary to resolve the situation and promote construction progress.

4. Meeting agenda:

    a. Review of construction progress since previous meeting.

    b. Field observations, interface requirements, conflicts.

    c. Issues which may impede construction schedule.

    d. Off-site fabrication.

    e. Delivery schedules.

    f. Submittal schedules and status.

    g. Site use; coordination with other contractors.

    h. Temporary facilities, controls, and services.

    i. Hours of Work.

    j. Hazards and risks.

    k. Housekeeping.

    l. Quality and Work standards.

m. RFIs.

n. Status of Change Orders.

o. Documentation of information for payment requests.

p. Corrective measures and procedures to regain construction schedule, if necessary.

q. Revisions to construction schedule.

r. Review of proposed activities for succeeding Work period.

s. Review proposed Agreement modifications for:

(1) Effect on construction schedule and completion date.

5. Location of meetings:

a. At Project Site.

6. Reporting

a. Within three (3) Business Days after each meeting, Contractor shall prepare and distribute minutes of the meeting to Owner and Owner's Representatives.

b. Contractor shall distribute copies to principal Subcontractors and Supplier.

E. Startup Coordination Meetings

1. Contractor shall conduct daily startup coordination meetings at the Project Site with option for the Owner to attend. Regular meetings shall be held starting when Contractor's Work begins commissioning and startup activities and shall continue until Substantial Completion is achieved. Contractor and its major Subcontractors shall attend and participate in the meetings.

2. Meeting agenda:

a. Review of commissioning progress.

b. Safety, hazard, and risk consideration.

c. Startup observations and deviations from procedures.

d. Coordination among multiple prime contractors as applicable.

e. Issues that may impede startup.

f. Construction interfaces affecting startup.

g. Delivery schedules.

h. Performance and acceptance testing.

i. Quality assurance and quality control issues.

j. Corrective and/or warranty issues.

k. Other items as appropriate.

F. Requests For Information (RFI):

1. Procedure: Promptly on discovery of the need for interpretation of the Agreement documents, and if not possible to request interpretation at Project meeting, prepare and submit an RFI with the content specified.

a. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor shall be returned with no response.

b. Coordinate and submit RFIs in a prompt manner to avoid delays in Contractor's Work or work of Subcontractors.

2. RFI Content

a. Include a detailed, legible description of item needing interpretation and the following:

(1) Project Site name.

(2) Date.

(3) Name of contractor.

(4) Agreement number and title.

(5) Name of engineer.

(6) RFI number, numbered sequentially.

(7) Specification section number and title and related paragraphs, as appropriate.

(8) Drawing number and detail references, as appropriate.

(9) Field dimensions and conditions, as appropriate.

(10) Contractor's suggested solution(s). If Contractor's solution(s) impact the Agreement times or the Agreement price, Contractor shall state impact in the RFI.

(11) Contractor's signature.

(12) Attachments: Include drawings, descriptions, measurements, photos, product data, shop drawings, and other information necessary to fully describe items needing interpretation.

3. Software-Generated RFIs

   a. Software-generated form with substantially the same content as indicated above.

   b. Attachments shall be electronic files in .pdf format.

4. Owner's Action: Owner shall review each RFI, determine action required, and return it. Contractor shall allow five (5) Business Days for Owner's response for each RFI. RFIs received after 1:00 p.m. local time shall be considered as received the following Working Day.

   a. The following RFIs shall be returned without action:

      (1) Requests for approval of submittals.

      (2) Requests for approval of substitutions.

      (3) Requests for coordination information already indicated in the Agreement documents.

      (4) Requests for adjustments in the Agreement times or the Agreement price.

      (5) Requests for interpretation of Owner's actions on submittals.

      (6) Incomplete RFIs or RFIs with numerous errors.

   b. Multiple RFIs addressing similar or identical issues may be addressed by Owner's with a single broad response.

   c. Owner's action may include a request for additional information, in which case Owner's time for response shall start again upon Contractor's response and resubmittal.

   d. If Contractor believes the RFI response warrants change in the Agreement times or the Agreement price, Contractor shall notify Owner in writing within ten (10) Business Days of receipt of the RFI response.

5. RFI Log: Contractor shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Contractor shall submit log monthly. Electronic log shall at a minimum contain the following:

   a. Project name.

   b. Name and address of Contractor.

c. Contractor representative name and telephone number.

d. Name and address of engineer.

e. RFI number including RFIs that were dropped and not submitted.

f. RFI description.

g. Date the RFI was submitted.

h. Date engineer's response was received.

i. Status (open/closed).

6. On receipt of Owner action, Contractor shall update the RFI log and promptly distribute the RFI response to affected parties. Contractor shall review response and notify Owner within five (5) Business Days if Contractor disagrees with response.

ATTACHMENT 3 TO EXHIBIT A-1
APPLICABLE STANDARDS

Without limiting the information summarized herein, the purpose of this attachment is to summarize the applicable industry codes and standards for Contractor's Work.

A. General Requirements

1. Applicable Standards shall include (a) each of the standards and industry codes listed below and (b) each of the relevant standards and codes issued by the organizations listed below. For the avoidance of doubt, any standards or industry codes not identified herein but pertinent to the Work shall also apply.

2. Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the Applicable Standards including, but not limited to, those listed herein. Any departure from the referenced codes and standards shall be fully explained in writing and submitted for Owner's review and approval prior to implementation.

3. All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.

4. Any general standard or organization listed below shall be understood to include all relevant codes, standards, and/or guidelines under that particular standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.

5. Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

B. Applicable Standards

1. Publication Dates: Comply with standards in effect as of date of the Agreement unless otherwise indicated.

2. Applicable state requirements, including State Department of Transportation

3. Aluminum Association ("AA")

4. American Association of State Highway and Transportation Officials ("AASHTO")

5. American Institute of Steel Construction ("AISC")

6. Association of Iron and Steel Engineers ("AISE")

7. American Iron and Steel Institute ("AISI")

8. American National Standards Institute ("ANSI")

9. American Society of Civil Engineers ("ASCE")

10. American Society of Heating, Refrigeration, and Air Conditioning Engineers (“ASHRAE”)
11. American Society of Mechanical Engineers (“ASME”)
12. American Society of Nondestructive Testing (“ASNT”)
13. American Society of Testing and Materials (“ASTM”)
14. American Water Works Association (“AWWA”)
15. American Welding Society (“AWS”)
16. Crane Manufacturer Association of America (“CMAA”)
17. Concrete Reinforcing Steel Institute (“CRSI”)
18. Code of Federal Regulations (“CFR”)
19. Department of Transportation (“DOT”)
20. United States Environmental Protection Agency (“EPA”)
21. Federal Aviation Agency, Department of Transportation (“FAA”)
22. Federal Communications Commission (“FCC”):
23. Federal Energy Regulatory Commission (“FERC”).
24. Federal Highway Administration (“FHWA”)
25. International Air Transport Association (“IATA”)
26. Illuminating Engineering Society (“IES”)
27. Institute of Electrical and Electronic Engineers (“IEEE”)
28. Instrumentation Society of America (“ISA”)
29. Insulated Cable Engineering Association (“ICEA”)
30. International Building Code (“IBC”)
31. International Fire Code (“IFC”)
32. International Electrical Testing Association (“NETA”)
33. International Electrotechnical Commission (“IEC”)
34. International Energy Conservation Code (“IECC”)
35. Illuminating Engineering Society of North America

36. International Maritime Organization (“IMO”)
37. International Safety Equipment Association (“ISEA”)
38. International Organization for Standardization (“ISO”)
39. Metal Building Manufacturers Association (“MBMA”).
40. National Electric Code (“NEC”)
41. National Electrical Contractors Association (“NECA”)
42. North American Electric Reliability Corporation (“NERC”)
43. National Electric Safety Code (“NESC”)
44. National Electrical Manufacturers Association (“NEMA”)
45. National Electrical Testing Association (“NETA”)
46. National Fire Protection Association (“NFPA”)
    a. AHJ 1 – Fire Code
    b. NFPA 68 – Standard on Explosion Protection by Deflagration Venting
    c. NFPA 69 – Standard on Explosion Prevention Systems
    d. NFPA 72 – National Fire Alarm and Signaling Code
    e. NFPA 101 – Life Safety Code
    f. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations
    g. NFPA 850 – Recommended Practice for Fire Protection for Electric Generating Plants and High Voltage Direct Current Converter Stations
    h. NFPA 855 – Standard for the Installation of Stationary Energy Storage Systems
47. National Safety Council (“NSC”)
48. Occupational Safety and Health Administration (“OSHA”)
49. Scientific Apparatus Makers Association (“SAMA”)
50. Steel Door Institute (“SDI”)
51. Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)
52. Society for Protective Coatings (“SPC”)

53. Telecommunications Industry Association/Electronic Industries Association ("TIA/EIA")

54. Underwriter's Laboratories ("UL")

    a. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems

    b. UL 1741 – Standard for Safety Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources

    c. UL 1973 – Standard for Safety Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications

    d. UL 9540 – Standard for Safety Energy Storage Systems and Equipment

    e. UL 9540A – Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A-2

SCOPE OF WORK (HV)

EXHIBIT A-2 SCOPE OF WORK (HV)

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ATTACHMENT 1 – APPLICABLE STANDARDS

EXHIBIT A-2 SCOPE OF WORK (HV)

1.0 EXHIBIT INFORMATION

1.1 Project Description

1.1.1 See Section 1.0 of Exhibit B-1 (*Project Specific Information*).

1.1.2 Contractor shall procure the Main Power Transformer and the Owner shall procure high voltage circuit breakers. Contractor shall install the Main Power Transformer and high voltage circuit breakers and engineer, procure, and construct the remaining Project Substation and Gen-tie for the BESS project.

1.1.3 Contractor shall coordinate design with other engineering firms responsible for scope outside of the Agreement as set forth in Exhibit E-1 (*Division of Responsibility*)

1.2 Purpose

1.2.1 This Exhibit defines the minimum scope, substation, gen-tie line features, and quality standards for the design, procurement, construction, testing, and commissioning of the electrical interconnection systems supporting the new BESS facility, as they relate to the Contractors proposal.

1.3 References

1.3.1 This Exhibit shall also be used in conjunction with other Exhibits, as applicable. The Specifications provided herein are intended to supplement other Exhibits but not necessarily duplicate; any Work exhibited in one and not in the other shall be executed as if it had been set forth in all.

1.4 Definitions

1.4.1 Unless defined in Exhibit A-1 (*Scope of Work (BESS BOP)*), terms that begin with an upper case shall have the meaning defined in the Agreement.

1.4.2 See Exhibit A-1 (*Scope of Work (BESS BOP)*) for respective meanings of terms used in this Exhibit, unless otherwise defined in this Exhibit.

2.0 GENERAL SERVICES

2.1 General Provisions

2.1.1 Contractor to submit 30%, 90%, and Issue for Construction (IFC) Design and detailed specifications and drawings for the interconnection system in conformance with this Exhibit and the local utility standards. Whenever in conflict, the local utility standards shall govern.

2.1.2 Contractor shall design, fabricate, furnish, install, test, and commission a complete functional, operating, interconnection system as specified herein with a high degree of reliability, integrity, maintainability, efficiency, and environmental compatibility which conforms to normally accepted standards of HV substation and gen-tie facilities. Contractor shall provide all components necessary for a fully functional substation.

2.1.3 Contractor shall furnish an interconnection into the existing [ ] kV Gen-Tie line from the new [ ]/[ ] kV Project Substation.

2.1.4 Contractor shall furnish a new [ ]/[ ] kV Project Substation.

(1) Project Substation shall consist of one (1) [ ] kV line position to the POI, one (1) [ ]/[ ] kV kV Contractor procured Main Power Transformer, appropriate number of MV breakers feeding the inverters, metering, switches, and all other associated Equipment to deliver a power factor (PF) as required by the PREPA Minimum Technical Requirements (MTR) (over entire plant operational temperature, power, and voltage range) to the POI.

2.1.5 Project shall be capable of operating safely and reliably in accordance with the terms and conditions of the Agreement, this "Scope of Work", PREPA Requirements, local utility standards and associated Exhibits.

2.1.6 Contractor shall design and construct the Project in accordance with the Agreement and the Requirements and in coordination with Exhibit G (*Owner-Procured Equipment*) and Exhibit A-1 (*Scope of Work (BESS BOP)).* Scope of Work shall consist of:

(1) Specify, receive, furnish, store, and install the Equipment and Materials including, but not limited to disconnect switches, circuit breakers, instrument transformers, main and auxiliary voltage transformers, capacitor banks, substation structures, relay equipment, control enclosures, gen-tie line structures, all foundations, and associated ancillary hardware.

(2) Project design engineering, software models, and drawing packages for construction permitting, installation, and "as-built" documentation.

(3) Project design and construction including all site/civil work, structural, electrical, mechanical, fire protection, monitoring/control systems, and fencing.

(4) Project and construction management, including quality assurance/quality control, site safety, site material control, and management of all Subcontractors.

(5) Security requirements according to Owner's standards, as applicable.

(6) Project commissioning and testing shall be in accordance with these Exhibits, Contractor standards, and Equipment manufacturers' requirements, as approved by Owner.

(7) Project turnover including Owner/Operator training and Project operations and maintenance documentation, and Equipment warranty documentation.

2.1.7 Except as specified otherwise, provide all Equipment, Materials, transportation services, labor, labor supervision, technical field assistance, scheduling, consumables, construction equipment, construction tools, special tools, construction utilities, permanent utilities, testing services, instruments, spare parts, and other services and items required for, or incidental to the engineering, design, procurement, installation, construction, startup, testing, commissioning, and training for the Project. Supply of construction Equipment shall include fuel, lubricants, spare parts, and any other elements required for operation and maintenance.

2.1.8 Contractor shall procure and obtain all permits required for the construction of the project with the exception of permits acquired by the Owner. Contractor shall provide all design documents required to support Owner in obtaining any Owner Permits (if required) and other regulatory agreements.

2.1.9 Perform specified, code required, and Contractor's standard quality assurance testing, inspection, examination, and documentation.

2.1.10 Submit design, fabrication, and quality assurance documentation, and operating and maintenance manuals in accordance with the submittal requirements of the Agreement and the Requirements.

2.1.11 Contractor shall provide all design documents required to support Owner in obtaining permitting and other regulatory agreements.

2.1.12 Receive, inspect, store, unload, maintain, erect, clean, lubricate, align, and prepare all Equipment in strict accordance with Equipment manufacturer's instructions. Contractor shall arrange for and provide properly conditioned storage in strict accordance with manufacturer's requirements for all Equipment and Material to be incorporated into the Project.

2.1.13 Except as specified otherwise, provide all technical assistance, equipment, and supplies required, specialized and non-specialized, for erection, testing, commissioning, and start-up of Equipment furnished and installed by Contractor.

2.1.14 Contractor shall assist in unloading, installing, commissioning, and testing the Contractor procured Main Power Transformer.

2.1.15 Contractor shall conduct start-up and commissioning activities independently. Contractor will turn over site to Owner once start-up and commissioning activities have been completed.

2.1.16 Train Owner's operating and maintenance personnel on all operating and maintenance aspects of the Project prior to system start-up. Contractor shall complete all formal training efforts prior to start-up of associated system, including training for Owner supplied Equipment. Contractor shall provide all facilities necessary for all required training.

2.1.17 Fire protection during construction shall meet the requirements of NFPA 241, all other applicable NFPA standards and applicable local codes. All fire protection systems shall be subject to the review and approval of the associated AHJ.

2.1.18 Provide all special tools and lifting devices for Equipment supplied by Contractor as required for operations and maintenance of Contractor furnished Equipment and Materials.

2.1.19 Contractor shall furnish and maintain temporary construction facilities and provide construction services in accordance with Section 2.8 of Exhibit A-1 (*Scope of Work (BESS BOP)*) including, but not limited to, the following aspects applicable to the Project Site:

(1) Temporary storage facilities at the Project Site for the proper unloading and storage of all Contractor furnished Project Substation Equipment and Materials delivered to the Project Site. If adequate facilities are not available, such material shall be stored at suitable off-site facilities (e.g., warehouses, storage yards, etc.) provided by Contractor.

(2) Contractor shall be responsible for all transmission and distribution electric power tie-ins at the Project Site.

2.1.20 Contractor shall be responsible for design, permitting, and implementation of dust suppression and erosion control measures. Contractor shall provide all water for dust suppression.

2.1.21 Contractor is responsible for storm water quality requirements or retention basin requirements during construction as required. Permanent storm water quality requirements shall be installed in accordance with the drainage requirements of the associated AHJ.

2.1.22 Contractor shall provide the following studies to Owner for review, which shall be prepared by a professional engineer licensed in the jurisdiction of the Project and meet all the local utility requirements:

(1) Protective Device Coordination Study including time coordination curves and a narrative document explaining relay settings philosophy and calculations.

(2) Electronic settings files for insertion to applicable relays.

(3) Load Flow and Reactive Power Study.

(4) Short Circuit Study.

(5) Transient Overvoltage Study.

(6) Lightning Study.

(7) Illumination/Lighting Study.

(8) AC and DC Sizing Studies.

(9) Pre-Energization Harmonics Study.

(10) Insulation Coordination Study.

(11) Grounding System Study (including step and touch potential).

(12) Any other studies required by the Interconnection Agreement, Power Purchase Agreement, PREPA MTRs or by the local utility/ISO.

2.1.23 Contractor shall provide all necessary information and facility models (PSCAD, PSS/E, PSLF, short circuit, or other) required by PREPA, NERC, FERC, local utility, or ISO.

2.1.24 The contractor shall furnish and install a communication link between the Project Substation and the control building.

2.1.25 Contractor shall furnish and install a primary and secondary fiber optic communication link from POI to the Project Substation as required by the interconnecting utility. The secondary path shall be physically separate and diverse from the primary communication path if required by the local utility.

2.1.26 Contractor shall upgrade the access road(s), as required, to allow delivery of the Main Power Transformer.

2.1.27 Contractor shall comply with all requirements of the transmission provider.

2.1.28 If brown power is available, Contractor shall supply back-up power for the Project Substation through local distribution system and emergency power from the Project Substation second auxiliary transformer. If brown power is not available, Contractor shall supply a stand-by emergency generator as emergency power to the backfeed from the transmission system and a second Project Substation auxiliary transformer to provide back-up power .

2.1.29 Contractor shall conduct any additional geotechnical studies as required.

2.2 Construction Facilities and Services

2.2.1 Safety and Security

(1) Sufficient access space shall be provided for maintenance of all Equipment.

(2) Project Substation shall meet requirements of Critical Infrastructure Protection (CIP) and North American Electric Reliability Corporation (NERC) for security as required.

2.2.2 Fire Protection

(1) Only work procedures which minimize fire hazards to the extent practicable shall be used. Combustion debris and waste materials shall be collected and removed from the site each day. Fuels, solvents, and other volatile or flammable materials shall be stored away from the construction and storage areas in well-marked, safe containers. Good housekeeping is essential to fire prevention and shall be practiced by Contractor throughout the construction period. Contractor shall follow the recommendations of the Associated General Contractors “Manual of Accident Prevention in Construction” regarding fire hazards and prevention.

(2) Formwork, scaffolding, planking, cabling, and similar materials which are combustible, but are essential to execution of the Work shall be protected against combustion resulting from welding sparks, cutting flames, and similar fire sources.

(3) Contractor shall provide qualified personnel for fire control as appropriate. Contractor shall provide adequate fire protection equipment in each warehouse, office, and other temporary structures, and in each work area occupied. Suitable fire extinguishers shall be provided in enclosed areas, in areas that are not accessible to fire protection water, or in areas that may be exposed to fire that cannot be safely extinguished with water. Each fire extinguisher shall be of a type suitable for extinguishing fires that might occur in the area in which it is located. In areas where more than one type of fire might occur, the type of fire extinguisher required in each case shall be provided. Each extinguisher shall be placed in a convenient, clearly identified location that shall most likely be accessible in the event of fire.

(4) Contractor shall be responsible for providing adequate fire protection of the construction areas.

2.2.3 Cleanliness

(1) Contractor shall keep the Project Site and surrounding grounds clean and free from trash and debris.

(2) Contractor shall require all disciplines to thoroughly clean their work areas each working day.

(3) Contractor's construction manager shall be responsible for site maintenance and cleanliness. This shall include sweeping the floor, collecting and disposing of trash, and all other functions required to keep the site clean. All hoses, cables, extension cords, and similar materials shall be located, arranged, and grouped so they shall not block any access way and shall permit easy cleaning and maintenance.

(4) Roll-up of all hoses, welding leads, and electrical cords shall be executed at a minimum once a month or as determined by site management. Equipment and Materials not required for immediate use or installation shall be stored in designated laydown and warehouse areas.

(5) All trash, debris, and waste materials shall be collected, sorted, and deposited in waste collection receptacles near the work. These receptacles shall be emptied by Contractor regularly and the waste disposed of properly and off-site.

(6) Promptly upon the completion of a construction task, Contractor shall thoroughly clean the equipment or structure affected by the task activity by removing all accumulations of dirt, scraps, waste, oil, grease, weld splatter, insulation, paint, and other foreign substances. Contractor, without additional cost or burden to Owner, shall properly and adequately restore surfaces affected by deposits of insulation, concrete, paint, weld metal, or other adhering materials.

2.2.4 Energized Facilities

(1) Contractor shall be completely responsible for the safety and protection of its personnel, the Owner's personnel, any and all other personnel of third parties and other contractors, and the public, and shall employ all methods necessary to achieve such safety and also assure continuity of all service systems encountered. These methods shall include, but not be limited to, providing barriers, guard structures, insulating guards and sleeves, warning signs, and prevention of unauthorized access to service system areas.

2.2.5 Reference Points

(1) Contractor shall establish baselines, monuments, and reference points for construction as necessary to proceed with layout of the work. Contractor shall be responsible for laying out the work to such lines and grades indicated on the drawings and shall protect and preserve the established reference points.

2.2.6 Adjoining Utilities

(1) Contractor shall make necessary efforts to protect the existing power gen-tie facilities, any and all parallel, converging, and intersecting electric lines and poles, telephone lines and poles, highways, waterways, railroads, and any and all property from damage as a result of its performance of the Work. Contractor shall bear all liability for and shall at its expense repair, rebuild or replace in kind any property damaged or destroyed caused by the Contractor in the course of its performance of the Work.

2.2.7 Minimum design working life shall be as provided in Section 2.0 of Exhibit B-1 (*Project Specific Information*).

2.2.8 Project design shall be based upon the design conditions listed Exhibit B-1 (*Project Specific Information*).

2.2.9 Project shall be designed for automatic, unmanned operation.

2.2.10 Project design shall be in compliance with applicable codes and standards referenced in Attachment 3 (*Applicable Standards*) to Exhibit A-1.

3.0 EQUIPMENT AND MATERIALS

Contractor shall furnish all Equipment and Materials as required to construct a fully functioning Project. Minimum requirements for major Equipment are described herein.

3.1 34.5 kV Capacitors, Shunt (if required)

3.1.1 Nominal system voltage: 34.5 kV.

3.1.2 Reactive power: To be determined by Load Flow Study.

3.1.3 Frequency: 60 Hz.

3.1.4 Capacitors shall be single phase.

3.1.5 Capacitors shall be equipped with an internal discharge device which shall reduce the residual voltage to 50 volts or less within 5 minutes.

3.1.6 The maximum size of a single step capacitor bank shall be determined by the voltage flicker analysis.

3.2 34.5 kV Circuit Breakers

3.2.1 Model/Type: VCB.

3.2.2 Rated Voltage; Nominal: 34.5 kV.

3.2.3 Rated Voltage; Maximum: 38 kV.

3.2.4 BIL: 200 kV.

3.2.5 Rated Current-RMS: Continuous: 2000 A Main and 1200 A Feeder.

3.2.6 Rated Current-RMS: Interrupting: 25 kA, 31.5 kA or 40 kA based on short circuit study by Contractor.

3.2.7 Current Transformer:

X	Y	Z	Bushing	Z	Y	X
A	A		5	6	A	A
A	A		3	4	A	A
A	A		1	2	A	A
			Ratio			

A: 1200:5 A

B: N/A

Relay accuracy classification: C400 or C800

C57.13 metering accuracy current transformers: N/A

Thermal Rating Factor: 2.0 (minimum)

3.2.8 Training Control Voltage: 120/240 VAC.

3.2.9 Control Voltage: 125 VDC.

3.2.10 Voltage for Space Heater: 120 V Single Phase.

3.3 [ ] kV Disconnect Switches

3.3.1 Nominal System voltage: [ ] kV.

3.3.2 Basic Impulse Level: [ ] kV.

3.3.3 Continuous current: [ ] A.

3.3.4 RMS Momentary current: 64/80/101 kA

3.3.5 Peak Asymmetrical current: 104/130/164 kA

3.3.6 Motorized group operated air-break.

3.3.7 Switches rated [ ] kV shall be vertical break.

3.3.8 Switchblades and related current-carrying parts shall be of aluminum alloy construction and contact making components shall be of silvered inlay copper or other approved metals.

3.3.9 Provide 4-hole or 6-hole NEMA terminal pads at each high-voltage connection.

3.3.10 Design to provide smooth, completely controlled simultaneous movement of switchblades throughout the entire cycle of operation with mechanism continually loaded to prevent switch from alternately leading or lagging the control.

3.3.11 Furnish group operated mechanism with necessary rods, bell cranks, interphase operating connections, bearings, supports, linkages, and vertical operating pipe. All operating pipe connections shall have set screws. All operating pipes shall be furnished precut to the specific lengths required for the phase spacing and bus height indicated.

3.3.12 Provide with permanently double sealed maintenance free automotive steel ball bearing assemblies.

3.3.13 Provide for individual adjustment of the operating mechanism of each pole; all hardware shall be fabricated with non-corrodible metal.

3.3.14 Provide a semaphore to be located at or near each operating mechanism to give positive indication of the open or closed position of the switch.

3.3.15 Operating handles or cranks shall have provision for locking in both the open and closed position.

3.3.16 Provide bolted ground connector and flexible grounding jumper for operating handle.

3.3.17 Switch bases shall be heavy duty galvanized steel.

3.3.18 Switches shall be of an essentially maintenance-free design.

3.3.19 [ ]kV switches shall be provided with worm gear operating mechanisms operated with a non-detachable crank having a clockwise operation of crank to close switch, with all gears and worms completely sealed, and requiring a torque of no more than 35-pound feet to operate the switch.

3.3.20 Furnish mechanically operated auxiliary switches with operating points individually adjustable over the entire travel of the operating mechanism.

3.4 [ ] kV Surge Arrester

3.4.1 Nominal System Voltage: [ ] kV.

3.4.2 Arrester rating: [ ] kV MCOV.

3.4.3 Outdoor Station Class.

3.4.4 Polymer or Porcelain.

3.4.5 Mounting: Vertical.

3.5 38 kV Surge Arrester

3.5.1 Nominal System Voltage: 34.5 kV.

3.5.2 Arrester rating: 27 or 29 kV MCOV.

3.5.3 Outdoor Station Class.

3.5.4 Polymer or Porcelain.

3.5.5 Mounting: Vertical.

3.6 [ ] kV CCVTs

3.6.1 Nominal System Voltage: **[ ]** kV.

3.6.2 Basic impulse level: **[ ]** kV BIL.

3.6.3 Frequency: 60 Hz.

3.6.4 Accuracy: **[ ]** W, M, X, Y, Z

3.6.5 Secondary Windings: **[ ]**

3.6.6 Base mounted with potential adjusting unit mounted in the capacitor base or in separate weatherproof housing.

3.7 34.5 kV VTs

3.7.1 Nominal System Voltage: 34.5 kV.

3.7.2 Basic impulse level: 200 kV BIL.

3.7.3 Frequency: 60 Hz.

3.7.4 Accuracy: **[ ]** W, M, X, Y, Z

3.7.5 Secondary Windings: **[ ]**

3.8 Station Service Transformer

3.8.1 Size to be determined by Contractor for review and approval by Owner.

3.9 Tubular and Strain Bus

3.9.1 Provide schedule 40, 6063-T6 seamless aluminum bus.

3.9.2 Provide corona-free and watertight welded end covers on all exposed ends.

3.9.3 Bus diameter shall be determined in accordance with the methods given in IEEE 605.

3.9.4 Provide corona rings as required for high voltage fittings.

3.9.5 Provide internal damping cable to reduce Aeolian vibration.

3.9.6 Damping cable dimensions and weight shall be determined in accordance with the methods given in IEEE 605.

3.9.7 Bus shall withstand the stresses from short circuit forces stated in design criteria.

3.10 Bus and Switch Insulators

3.10.1 Provide station post bus insulators rated as indicated in design criteria. Minimum cantilever strength shall be determined in accordance with the methods given in IEEE 605, including wind and short circuit overload factors.

3.11 Bus Connector and Fittings

3.11.1 Provide connectors and fittings as required.

(1) Connectors shall be welded type for aluminum tubing connections and compression or puddle welded type for aluminum cable connections. Use expansion type connectors with internal ball-type alignment guides where tubing connections are made to switches.

(2) Fittings shall develop the full strength of the conductor and shall be capable of carrying the full current capacity of the conductor.

3.11.2 Bus support clamps for rigid bus shall be fixed or slip type as required to firmly support the bus while allowing for temperature expansion and contraction.

3.11.3 Provide bolted ground connector and flexible type grounding jumper for operating handles of disconnect switches.

3.11.4 Provide bus grounding stud weldments on main bus in at least three locations.

3.11.5 Provide wire guides and bundled conductor spacers as required and indicated to maintain adequate clearance and support on cable jumpers, connections, and overhead lines.

3.12 Relaying

3.12.1 Project Substation

(1) Relays shall be Schweitzer Engineering Laboratories (SEL) or approved equal and of the model and type as approved by the interconnecting utility/transmission provider for substation relays:

(a) Line Differential.

(b) Line Distance.

(c) Breaker Failure.

(d) Line Pilot Protection and Breaker Failure Protection Communications.

(2) High Side Transformer Breaker

(a) Breaker Failure.

(3) Transformer

(a) Transformer Differential Primary.

(b) Transformer Differential Secondary.

(4) 34.5 kV Feeders

(a) Feeder Protection.

(b) Breaker Failure

(5) 34.5 kV Capacitor Bank (if required)

(a) Overcurrent.

(b) Voltage.

4.0 CIVIL WORKS

4.1 General Provisions

4.1.1 This section covers the minimum scope and quality requirements for the Project Substation civil design and construction.

4.1.2 Contractor shall comply with additional civil design requirements as specified in Exhibit A-1 (*Scope of Work (BESS BOP)*).

4.1.3 If the above requirements contradict, the more stringent requirements will take precedence.

4.2 Site Improvements

4.2.1 Duct Banks

(1) Underground banks of power and instrument conduit shall be encased in concrete.

(2) Encasements shall be reinforced to withstand AASHTO HS20 loading at way crossings and non-paved Equipment access areas susceptible to damage by cranes, trucks, etc. Refer to Section 7 of this Exhibit for required compressive strength of concrete encasement.

(3) Concrete at the top of the duct bank shall be colored red.

4.2.2 Crushed Stone Surfacing

(1) Crushed rock surfacing within the Project Substation fence shall be 4 inches thick with a resistivity of 3000 ohmmeters.

(2) Crushed rock shall conform to ASTM C33, gradation 1-1/2 to No. 8 particles.

5.0 STRUCTURAL WORKS

5.1 General Requirements

5.1.1 This section covers the minimum scope and quality requirements for the Project Substation structural design and construction.

5.1.2 Contractor shall comply with additional structural design requirements as specified in Exhibit A-1 (*Scope of Work (BESS BOP)*).

5.1.3 If the above requirements contradict, the more stringent requirements will take precedence.

5.2 Materials

5.2.1 Steel

(1) Design of structural and miscellaneous steel shall be in accordance with the following codes and standards:

(a) American Institute of Steel Construction (AISC) “Manual of Steel Construction”.

(b) American Society of Civil Engineers (ASCE) “Substation Structure Design Guide, Manual of Practice 113”.

(c) “Design of Steel Transmission Pole Structures”, ASCE/SEI 48.

(d) “Minimum Design Loads for Buildings and Other Structures”, ASCE/SEI 7.

(e) International Code Council “International Building Code (IBC)”.

(f) American Association of State Highway and Transportation Officials (AASHTO) "AASHTO LRFD Bridge Design Specifications

(g) Seismic design shall be in accordance with the Institute of Electrical and Electronics Engineers (IEEE) “IEEE Recommended Practice for Seismic Design of Substations”, IEEE 693.

(h) "Design of Latticed Steel Transmission Structures", ASCE 10.

(i) Institute of Electrical and Electronics Engineers (IEEE) "National Electrical Safety Code (NESC)".

(2) Materials for structural steel and miscellaneous steel shall conform to the following requirements of the American Society for Testing and Materials (ASTM):

(a) Wide Flange (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50 or multi-certification A36/A572, Grade 50.

(b) M shapes, S shapes, HP (Bearing Piles), Channels, and Angles: ASTM A36.

(c) Structural Plates and Bars: ASTM A36.

(d) Square/Rectangular Hollow Structural Sections (HSS): ASTM A500 Grade C.

(e) Tubular: a structure composed of closed sections (tubes) of circular, multi-sided, or elliptical cross section and tapered or un-tapered: ASTM A572, Grade 65.

(f) Pipe: A53, Grade B.

(3) High strength bolts, nuts, and washers shall conform to ASTM F3125, ASTM A563, and ASTM F436, respectively and shall be galvanized in accordance with ASTM A153 and ASTM F2329 as applicable.

(4) Bolts, nuts, and washers under one-half inch in diameter shall conform to ASTM A307, Grade B, ASTM A563 and ASTM F844, respectively and shall be galvanized in accordance with ASTM A153 and ASTM F2329 as applicable.

(5) Anchor bolts, anchor bolt assemblies, and concrete embeds shall be galvanized in accordance with ASTM A153.

(6) Anchor bolts shall conform to ASTM F1554.

(7) All structural welding shall conform to the requirements of AWS D1.1 (and D1.8 seismic supplemental where applicable).

(8) Galvanizing, as specified herein, shall conform to the requirements of ASTM A123, ASTM A143, ASTM F2329, and ASTM A153 as applicable.

(9) Stainless steel shall conform to ASTM A240 and ASTM A276 as applicable.

5.2.2 Aluminum

(1) Design of structural and miscellaneous aluminum shall be in accordance with the latest version of the Aluminum Association “Aluminum Design Manual” and “Aluminum Standards and Data”.

(2) Materials for structural and miscellaneous aluminum, including structural shapes and plate, shall conform to ASTM B209 and ASTM B308 and shall be aluminum alloy 6061-T6.

(3) Bolts and nuts shall conform to ASTM F468 and ASTM F467, respectively and shall be aluminum alloy 6061-T6.

(4) Washers shall be aluminum-clad steel, Alclad 2024-T4, or approved equal.

5.2.3 Concrete

(1) Design of structural concrete shall be in accordance with the latest version of the American Concrete Institute (ACI) "Building Code Requirements for Structural Concrete," ACI 318.

(2) Concrete formwork shall conform to ACI 347.

(3) Concrete mix proportions, including documentation of materials, admixture product information, and compressive strength of mix, shall be submitted, and approved by the Owner prior to placing concrete.

(4) Minimum concrete compressive strength (at 28 Days) for various structures shall be as follows:

(a) Electrical Ductbanks: 3000 psi (with a max water-cement ratio of 0.5).

(b) Major Equipment/structures where required and all other construction: 4000 psi for interior slab-on-grade or 4500 psi for substation foundations or higher as required by design (max water-cement ratio of 0.45).

(5) Reinforcing bars shall be deformed bars conforming to ASTM A615, Grade 60. Welded wire reinforcement shall conform to ASTM A1064. Plain wire shall conform to ASTM A1064. Placement shall be in accordance with ACI 318 and the Manual of Standard Practice of The Concrete Reinforcing Steel Institute.

(6) Cement shall be Portland cement conforming to ASTM C150 Type I, ASTM C150, Type I, or ASTM C595 Type IL, or as recommended by the Project geotechnical report.

(7) Aggregates for normal weight concrete shall conform to ASTM C33 with max coarse aggregate number 67.

(8) Slump of concrete used for substation foundations shall be the following unless otherwise noted:
General Use (Mats, Footings): 3"-4"
Uncased Drilled Piers: 6"-7"
Drilled Piers (With Temporary Casing): 7"-8"
Duct Bank: 6"-7"

(9) All foundations shall extend a minimum of 6 inches above the adjacent finish grade.

(10) Concrete trucks shall be rinsed in designated washout areas conforming to environmental permit requirements. Rinse material shall be properly disposed of off-site.

(11) Test Requirements

(a) The following testing shall be conducted in accordance with the specified reference unless otherwise indicated herein. All associated costs are the responsibility of the Supplier unless specifically identified as Purchaser-conducted. If identified as Purchaser-conducted, costs for the initial test will be the responsibility of the Purchaser. However, the Contractor is responsible for all costs associated with correcting deficiencies and retesting in the event of a test failure:

Tests	In Accordance With / Description	Conducted By
Charpy "V" notch	ASTM A370 and A673	Contractor
Weld tests	AWS D1.1	Contractor
Ultrasonic Testing	Ultrasonic Testing of all plates over 1 ½" in thickness to assure against defects which could lead to lamellar tearing.	Contractor

5.3 Structural Foundations

5.3.1 Type of foundations required and allowable bearing values shall be as recommended by the geotechnical engineer based on the subsurface conditions found in the Project geotechnical report.

5.3.2 All loose materials shall be removed from excavation bottoms prior to foundation placement.

5.3.3 Unsatisfactory foundation subgrade material shall be removed and replaced with compacted structural fill material or with 2000 psi concrete.

5.3.4 Total foundation settlements shall be limited to one inch or as required by applicable building or industry codes and Equipment supplier's recommendations. Differential settlement shall be limited to requirements of the equipment manufacturer.

5.3.5 Transformer Foundation and Containment

(1) Transformers shall be provided with secondary oil containment equal to 110% of the volume of oil present in the transformer in addition to the volume of rainwater for a 100-year storm event over the area of the containment.

(2) Containment areas shall have water stops compatible for fluid it is containing embedded within concrete that does not rely upon a sealant.

5.4 Project Substation Control Building

5.4.1 Project Substation control building shall contain relay and communications panels, telecommunication panel, an RTU, station service equipment, and other items associated with the Project including any required utility/ISO Equipment.

5.4.2 To reduce site congestion, building shall be delivered as a single, completely assembled unit to the greatest extent practical. Contractor shall unload and place on foundation.

5.4.3 Roof and supporting structure shall be designed for minimum 30 psf uniformly distributed load plus a 200-pound concentrated load over a 1'x1' area located anywhere on the roof surface plus any interior loads imposed by suspended equipment or cable tray.

5.4.4 For snow, wind and uplift loads, structure and anchorage shall be designed according to the locally adopted building code and ASCE 7 based on site-specific parameters and the applicable Risk Category.

5.4.5 Floors shall be designed for a minimum of 350 psf loading.

5.4.6 Design for loading of battery rack; batteries; charger; electrical equipment and raceways; heating, ventilating, and air conditioning equipment; relay switchboards; and transformers, lighting, and other miscellaneous items as required.

5.4.7 Enclosure base shall be all welded steel frame construction.

5.4.8 Enclosure floor shall be a minimum of 1/4 inch steel plate welded to the base.

(1) Provide special anchoring and support members under the battery racks and relay control panels.

(2) Floor shall be finished with a non-skid coating.

(3) Floor and walls shall be insulated to a minimum R11 value.

(4) Provide a bottom plate to enclose and protect the insulation.

(5) Entire enclosure shall be framed with an equivalent 3 inch square tubular steel. All openings, such as doors, windows, etc., shall be similarly framed with 3-inch square tubular steel or structural equivalent. Height from floor to ceiling shall be 10-feet minimum.

5.4.9 Exterior walls shall be galvanized steel panels. Interior walls shall be a minimum of 24 gauge paint quality galvanized substrate.

(1) Walls shall be designed and assembled to allow for future lateral expansion of the enclosure.

(2) Interior walls and supporting panels shall be designed so that interior loads of 400-pounds per linear foot of wall length may be attached to the wall without compromising the design wind loads.

(3) If additional reinforcement is required to mount equipment, the manufacturer may use Unistrut or equivalent.

5.4.10 Exterior of the roof shall be galvanized substrate panels.

(1) Roof shall be sloped away from door openings, at a 5 degree pitch, to allow for adequate drainage.

(2) Roof shall be designed to support interior loads of 100 pounds per linear foot of truss length without compromising the roof design load.

(3) Screened, louvered ventilation openings shall be provided, to prevent condensation in attic space.

(4) Snow guards shall be provided on the roof above doorways positions where equipment is mounted on the exterior.

5.4.11 Ceiling shall consist of formed 24 gauge paint quality galvanized substrate panels.

(1) Ceiling shall be designed to retain the insulation and to provide a smooth ceiling surface.

(2) Ceiling shall be insulated to a minimum value of R30.

(3) Interior ceiling and supporting structure shall be designed so that interior loads of 100 pounds per linear foot of truss length may be suspended from the ceiling without compromising the specified roof design load.

(4) Design for additional load, as required, to support cable tray, lighting, conduits, and other items provided by the Agreement and the Requirements.

5.4.12 The enclosure shall have two (2) separate 18-gauge heavy-duty steel doors: one (1) 36 by 84 inch and one (1) 72 by 96 inch with removable transom.

(1) Doors shall be equipped with low profile panic-type door hardware and an automatic door closer.

(2) Drip shield shall be provided above all doors.

(3) Each set of door hinges shall include one entry alarm hinge comprised of an integral SPST electric switch rated 125 VDC.

(4) Contractor shall provide and terminate a two-wire circuit from each alarm hinge to the RTU.

5.4.13 Room-type air conditioners shall be sized and provided by the Contractor based on the cooling/heating loads.

(1) Consideration shall be given to the ambient site conditions, dimensions, and heat retention of the enclosure building, and the heat dissipated by the control/monitoring Equipment inside the building.

(2) Equipment shall be capable of maintaining a building temperature of not more than 80°F for cooling and not less than 70°F for heating.

(3) Secondary heater shall be furnished with the intended use for partial redundancy in the event of a failure of the primary heating source.

(4) Contractor shall provide calculations of heating and cooling capacity requirements.

(5) Furnish and install one staging thermostat with two-stage heat and two-stage cooling that cycles equipment of both heating and cooling stages.

5.4.14 Interior lighting shall consist of fluorescent lights that provide 50 foot candles of light at a level three feet above the floor.

(1) Lighting shall be controlled by heavy-duty three-way switches located near each door.

(2) Lighting locations indicated on Contract Documents shall be modified as needed to meet illumination requirements.

(3) External lighting shall be provided above each personnel door with automatic operation provided by a photo-electrically controlled lighting contactor.

(4) Provide 100 watt, enclosed, weatherproof, heavy-duty high-pressure sodium fixtures.

(5) Emergency lighting shall consist of self-contained, battery powered units with two illuminating heads. Units shall switch-on automatically upon loss of AC power, shall provide 1.5 hours of continuous illumination, and shall recharge when AC power is resumed.

(6) Duplex receptacles, polarized, arc resistant, specification grade, shall be rated 120 VAC, 20 A. Lighting contactors and switches shall also be provided for all yard lighting.

5.4.15 Provide four cable risers to extend from yard cable trench and duct bank to cable entrance wall openings to access the building cable tray.

(1) A generation interface junction box containing terminal blocks shall be integral to one of the cable risers.

(2) Risers shall be designed and sealed to prevent infiltration of water, snow, dust, and animals into the cabinet or building.

(3) Cabinet shall be constructed of corrosion-resistant aluminum or stainless steel and meet or exceed NEMA standards.

(4) Risers shall be provided with removable, gasketed covers to accommodate easy access for cable installation and termination.

5.4.16 Provide wall mounted exhaust fans sized and located as required to provide proper ventilation for the selected battery arrangement.

(1) Provide a gravity intake damper with an exterior weather hood associated with each exhaust fan.

(2) Provide exhaust fan on/off toggle switches to control the exhaust fans and intake dampers.

(3) Provide a ceiling mounted hydrogen sensor, accessible by ladder and not mounted directly above the batteries, but in close proximity.

5.4.17 Furnish and install AC panelboards sized as required and located generally as shown on the drawings.

5.4.18 Furnish and install all cable tray as shown on the drawings.

5.4.19 Furnish and install conduit and wireways as necessary to wire the control building.

5.4.20 Provide an automatic transfer switch for the incoming station service sources to allow immediate restoration of AC service in the event of loss of the primary station service source.

5.4.21 Provide safety switches for AC and DC systems.

5.4.22 Provide station service transformers for 120-240 V single-phase service.

5.4.23 Provide a battery system as described in Section 4 of this Exhibit.

5.4.24 Furnish and install one combination smoke and heat detector unit with one normally open and one normally closed alarm contact rated 5 A at 125 VDC.

5.4.25 Provide LED or fluorescent illuminated exit signs above each door.

5.4.26 Provide an appropriate eye wash station, a dry chemical fire extinguisher (ABC rated), and other items required or indicated for a complete building system.

6.0 ELECTRICAL

6.1 General

6.1.1 This section covers the minimum scope and quality requirements for the interconnection system.

6.1.2 Contractor shall provide all material and labor for the engineering, design, procurement, installation, construction, startup, inspection, and testing of all electrical systems specified herein and necessary for a complete substation in conformance with generally accepted practices.

6.1.3 Design and specifications of all Work shall be in accordance with all applicable industry codes and standards, and accepted standards of good engineering practice.

6.2 Project Substation System Studies

6.2.1 Contractor shall perform a set of studies and analyses to demonstrate the adequacy of the proposed electrical system design, by performing the following studies as a minimum, which are subject to review and comment by Owner. Design and construction of the electrical systems shall reflect the findings and conclusions of these studies:

(1) AC System Studies

(a) Capacity of the Project Substation low voltage AC system to determine size of station service.

(2) DC System Studies

(a) Load profile shall be developed for all DC loads to determine the capacity of the batteries and chargers with the DC service required for the Equipment at the Project Substation.

(b) Studies shall determine if the minimum voltages are maintained as specified and required by Equipment vendors.

(3) Short Circuit and Grounding Studies

(a) Ensure Equipment is rated to handle expected fault currents.

(b) Study shall assure that the ground grid modifications maintain touch and step voltages within tolerable limits.

(c) Study shall determine the ground potential rise (GPR) with respect to remote earth.

(d) Analysis of the ground grid shall have the following basis:

1. Fault current per Project characteristics.

2. 50 kg body weight.

3. A fault split factor may be applied.

4. Ground resistivity as determined from the Project geotechnical report.

5. Fault duration of 0.25 seconds.

(e) Ground grid design, including tolerable step and touch voltage and conductor fusing temperature, shall be in accordance with the procedures, data, and recommendations given in IEEE 80.

(4) Relay Coordination Study

(a) To ensure designed protection devices shall function properly to protect plant and its systems, as well as high side components.

(5) Load Flow Study

(a) To determine the necessity and size of capacitor banks and plant's ability to provide reactive power compensation and inform design as necessary.

(6) Transient Over-Voltage Study

(a) To determine the BESS plant can handle transient over-voltages and meet the coefficient of grounding requirements.

(7) Harmonic Study

(a) To determine estimated harmonics of BESS plant and interaction with grid. Any harmonic filters, however, shall be designed based on measurements at the plant once energized.

(8) Arc Flash Study

(a) To determine level of energy at each Equipment in the Project Substation and provide appropriate measures for its safe operation.

(9) Bus Design Analysis

(a) Analyze the performance of the Project Substation buses, disconnect switches, and separately mounted current transformers to determine the ampacity, structural integrity, vibration, and required mechanical and electrical ratings are in accordance with the methods and recommendations of IEEE 605.

(b) Bus design, including gust factor, exposure height factor, importance factor, and corona considerations, shall be in accordance with the procedures and data given in IEEE 605.

(10) Bus Ampacity

(a) Continuous current rating as given on the one-line diagram.

(b) Fault current as appropriate for the Project.

(c) A temperature of 50˚C with a minimum wind speed of 2 ft/sec perpendicular to the bus.

(d) Solar radiation with material absorptivity and emissivity to 0.5.

(11) Bus Structural Design (bus, insulators, bus structures and foundations)

(a) Use wind speeds and ice loads as appropriate for the Project.

(12) Seismic Calculations

(a) All seismic calculations for the major Project Substation Equipment as required shall be provided.

6.3 Mast for Direct Lightning Stroke Protection

6.3.1 Steel masts for direct stroke protection shall be round tapered seamless extruded or spun aluminum tubes.

6.3.2 Overall height of the masts above grade shall be determined from the direct stroke protection study. Mast design shall be for the site design.

6.3.3 Masts shall have a single uniform taper from top to bottom.

6.3.4 Each mast shall be capped with a suitable finial.

6.3.5 The Lightning Flash Density shall be assumed as “High”.

6.3.6 Each mast shall be equipped with an internal vibration dampening device.

6.3.7 Design of masts shall have a safety factor of 2 based on the allowable yield stress for the mast material in accordance with the latest ASCE specifications governing design of structures.

6.3.8 Horizontal deflection at the top of each free-standing mast shall be limited to L/20 of its height above foundation.

6.3.9 Each mast shall be provided with two grounding pads located 12-inches above the foundation.

6.4 Lighting

6.4.1 Lighting system shall be furnished for the Project Substation.

6.4.2 Lighting system shall provide personnel with illumination for Project Substation operation and maintenance under normal conditions and means of egress under emergency conditions.

6.4.3 Lighting system shall be designed in accordance with the Illuminating Engineering Society (IES) to provide acceptable illumination levels.

6.4.4 Lighting sources and fixture selections shall be based on the applicability of the luminaries for the area under consideration and shall comply with all local codes and standards.

6.4.5 Lighting levels shall meet the requirements of ANSI C2 (NESC).

6.5 [ ] / [ ] kV Project Substation

6.5.1 Contractor shall design and install the Project Substation and associated Equipment and Materials for the [ ] / [ ] kV substation.

6.5.2 Coordinated design between the Substation, Gen-Tie, and BESS plant shall determine the final placement of the structures and Equipment, feedback of Equipment status to the RTU, and associated details.

6.5.3 Contractor shall provide all interface points. Contractor shall provide for status to the RTU of all Project Substation Equipment including open/close indication, voltage, currents, and alarms (including battery/battery charger related alarms), and revenue meter information (power, energy, accumulators).

6.5.4 Contractor is responsible for all site preparation, foundations, fencing, control building, grounding, crushed rock, structures, switches, switchgears, instrument transformers, surge arresters, station service, instrument metering, relaying, conduit, cable, bus, conductor, connectors, insulators, and other associated equipment.

6.5.5 Project Substation shall conform to the requirements of IEEE 605, the IEEE C37 and C57 family of standards, and, in general, conform to the preliminary arrangements provided by Owner. Minimum conductor clearance criteria shall be per ANSI C2 (NESC). Clearances shall be increased at locations where additional clearances are required for access to site Equipment.

6.5.6 Design of the interconnect voltage and 34.5 kV systems shall be based on the short circuit study.

6.6 Installation of Major Project Substation Equipment

6.6.1 Contractor shall provide all equipment required for the installation of Project Substation Equipment and Materials.

6.6.2 Contractor shall receive, inventory, and store Project Substation Equipment.

6.6.3 Equipment to be installed at Project Substation shall be stored and protected.

6.6.4 Installation and assembly of Equipment and Materials shall be according to manufacturer's recommendations complete as specified and as required for operation and continuous service at the locations in accordance with Contractor's detailed design.

6.6.5 Contractor shall erect structures in strict compliance with the manufacturer's drawings and code markings and instructions, after foundations have completely cured. Contractor shall repair any and all cuts, welds, and damaged areas.

6.6.6 Contractor shall assemble, install, lubricate, and adjust all switches and operating mechanisms in accordance with the manufacturer's instructions.

6.6.7 Contractor shall erect and install all buses, bus supports, bus support insulators, strain insulators, conductors, shielding wires and masts, and interconnections as required by manufacturer's drawings.

6.6.8 Welded aluminum bus erection shall include fabricating all buses and interconnections to the correct length and shape. Bends shall be made with a hydraulic bender without kinks or surface damage. Field weld all pipe-to-pipe and pipe-to-fitting connections using inert gas arc welding. Submit to Owner complete details of the proposed welding procedure, experience record, and certification data on the person(s) proposed to do the welding, as well as samples of welds made at the jobsite in all four standard positions.

6.7 Battery System

6.7.1 Codes and Standards

(1) All equipment furnished under these specifications shall conform to applicable standards of IEEE, IEC, ICEA, ANSI, ASTM, NEC, NEMA, NFPA, and UL.

(2) All materials and devices shall be in accordance with the applicable requirements of the Federal "Occupational Safety and Health Standards." The latest edition of each code and standard shall apply.

6.7.2 Design and Construction

(1) Batteries shall be provided with racks, connection devices, tools, instruction books, and other standard items.

(2) Project Substation battery chargers shall be 130 VDC output, sized as required for 8-hour recharge while serving continuous load.

(a) Chargers shall include an AC circuit breaker in the charger input circuit to provide a disconnect point and overcurrent protection.

(b) Chargers also shall include DC ammeters, DC voltmeters, AC power failure alarm relays, high/low DC voltage alarm relays, ground detection alarm relays, and battery temperature compensation systems which reduce the charge rate if necessary.

(c) Chargers shall maintain output voltage (in a settable range between 130 V and 145 VDC) within 1/2 percent from no load to full load even with input voltage variation of 10 percent, maintain output voltage automatically without requirement for voltage readjustment, and automatically vary the charging rate in accordance with the requirements of the substation battery.

(3) Provide DC systems including batteries, chargers, and panelboards.

(a) Batteries shall be lead antimony.

(b) Battery size shall be determined using the battery load profile.

(c) Nominal voltage shall be 130 VDC with 58 cells.

(d) Each battery bank shall be sized to have enough stored energy capacity for a 12-hour duty cycle, based on the DC load study for the applicable station.

(e) Battery shall be capable of being recharged to rated capacity from a discharge down to zero volts per cell, following an equalization charge.

(f) Battery shall be capable of being recharged within 8 hours following a complete discharge.

(g) Design shall be based on an 8-hour discharge time to 1.75 V per cell and the voltage is to be maintained for the specified design life of the battery.

(h) Battery shall be sized accordingly to accommodate ultimate design loads.

(4) Each battery cell shall be wet cell, lead-acid pasted plate-type with lead-calcium alloy plate grids or sealed type for the specified design life.

(a) Cell containers shall be sealed, clear, shock absorbing, heat resistant plastic, with electrolyte high and low-level markers and spray-proof vents.

(b) Batteries shall be manufactured for full float service with a high discharge rate, low deterioration rate, and low maintenance.

(c) Batteries shall be supplied complete with all accessories (e.g., battery rack, inter-cell connectors).

(d) Racks shall be a 2-step configuration.

(5) DC switchboard and panel shall have a main bus current rating as required to supply the connected load.

(a) Continuous current ratings and interrupting ratings of the feeder breakers shall be based on the available fault current and the characteristics of the connected loads or the battery chargers.

(b) Each panelboard shall include the feeder breakers required to supply the connected loads.

(c) Switchboard shall include bus voltmeter, battery ammeter with shunt, ground detection and alarm, and low voltage alarm.

6.7.3 Rating

(1) Contractor shall determine the capacity of each battery in accordance with the methods of IEEE 485 and this Exhibit.

(a) With the battery initially fully charged at the floating voltage specified, and with the battery chargers disconnected, the battery shall be capable of supplying the duty cycle specified.

(b) The ambient temperature during the duty cycle shall be 25°C.

(c) An aging factor of 25% and design margin of 20% shall be used.

(d) Contractor shall submit battery calculations for approval.

6.7.4 Duty Cycle

(1) The duty cycle for battery sizing shall include:

(a) One minute at the level of current required to operate Project Substation circuit breakers plus the continuous load.

(b) Duration of continuous load to be reviewed and approved by Owner.

(c) One minute at the level of current required to operate all Project Substation circuit breakers plus the continuous load.

6.7.5 Battery Chargers

(1) Each battery charger-eliminator furnished shall be self-regulating, natural cooled, solid-state silicon controlled full wave rectifier type designed for single and parallel operation with the batteries specified under this Exhibit.

(2) Charger shall be able to provide the DC load requirements in the event that battery is disconnected.

(3) Chargers shall be served from the Project Substation AC system.

(4) Charger shall maintain output voltage within plus or minus 0.5% from no load to full load, with an input power supply deviation in voltage level of plus or minus 10% and an input power supply deviation in frequency of plus or minus 5%.

(5) Solid-state electronic circuits shall have AC and DC transient voltage protection and shall be designed to recharge a totally discharged battery without overloading and without causing an interrupting operation of AC or DC circuit breakers.

(6) Charger shall be a full capacity charger and shall have the capacity to recharge the battery in 8 hours following complete discharge.

(7) Charger shall have an equalizing charge mode.

(8) Charger shall be self-regulating after charging levels are manually selected.

(9) Charger shall be manufactured in NEMA 1 enclosures suitable for placement in an indoor, environmentally controlled atmosphere.

(10) Charger shall require only front access and shall allow either top or bottom conduit/cable entry.

6.8 Raceway

6.8.1 This section covers furnishing and field installation of a complete raceway system in accordance with these specifications.

6.8.2 Raceway shall conform to the recommendations included in IEEE 525.

6.8.3 Raceway system is defined to include conduit, flexible conduit, underground duct, wireway, cabinets and boxes, and all materials and devices required to install, support, secure, and provide a complete system for support and protection of electrical conductors.

6.8.4 Raceway that contains multiple cable circuits shall have all cables with identical insulation ratings.

6.8.5 Individual raceway systems shall be established for the following services:

(1) 600 V control cable, AC power and control cables.

(2) Special electrical noise-sensitive circuits.

6.8.6 Routing of Above Grade Raceway and Conduit

(1) Contractor shall route raceway and conduit and shall coordinate conduit locations with other Equipment and structures.

(2) All raceway and conduit shall be installed in a neat, rectangular form. Special attention shall be given to securing a neat appearance. All raceway and conduit shall be installed perpendicular or parallel to the major Equipment and bus structures.

6.8.7 Material

(1) Underground duct system materials furnished under these Requirements shall be new and undamaged and shall conform to the following requirements:

(a) Duct

1. Polyvinyl chloride, Schedule 40 PVC in accordance with NEMA TC 2.

(b) Couplings

1. Plastic, for use with duct previously specified and "Duct-to-steel" adapters as required, including joint cement.

(c) Spacers

1. Plastic high impact, interlocking, base, and intermediate type.

(d) Factory Bends and Sweeps

1. Schedule 40 PVC, 36-inch minimum radius.

(e) End Bells

1. Plastic.

(f) Plugs

1. Plastic, high impact, tapered to fit end bell provided.

(g) Duct Binder

1. Hemp or sisal twine coupling.

(h) Riser Termination

1. Rigid hot-dip galvanized mild steel coupling.

(i) Riser Bends

1. Rigid steel conduit elbows, factory or field made, 36-inch minimum radius, 90 degree, entirely concrete encased below grade.

2. Hot-dip galvanized rigid mild steel in accordance with ANSI C80.1 and UL 6.

3. Conduit interior and exterior surfaces shall have a continuous zinc coating with an overcoat of transparent enamel or transparent lacquer.

6.9 Conductors

6.9.1 Power conductor size and ampacity shall be coordinated with circuit protection devices.

6.9.2 Conductor size shall be determined for 125% of connected load, or the short circuit duty, at the design basis maximum outdoor ambient temperature. Below grade power cable conductor size shall be determined in accordance with the methods in IEEE 835.

6.9.3 Insulated cable, conductors, and conductor accessories shall be furnished and installed in accordance with the requirements of these Requirements and the recommendations given in IEEE 525.

6.9.4 Insulated cable, conductors, and conductor accessories shall be furnished in quantities sufficient for a complete installation as indicated in these Requirements.

6.9.5 Installation shall be defined to include the following:

(1) Placement, splicing, terminating conductors.

(2) Coiling and taping of spare conductors.

(3) Identification, testing, and verification of each circuit, cable, and conductor.

(4) Manufacturer’s pulling or side wall tension shall never be exceeded. Contractor shall submit recorded cable tension reports.

6.9.6 All Project Substation control and instrument cables shall be shielded. Connectors, sizes 12 - 2 AWG, shall be vinyl or nylon pre-insulated ring-tongue type and power connectors, sizes 1 AWG – 750 MCM, shall be uninsulated two-hole rectangular tongue.

6.9.7 Cable Specifications

(1) Cable furnished shall be flame retardant construction in accordance with the applicable ASTM, ICEA, IEEE, WC and UL standards and suitable for wet or dry locations.

(2) All cable shall have surface printing showing manufacturer's name, insulation type, jacket type, conductor size, conductor type, voltage rating, and numbered footage markers.

(3) Control and instrument cables shall be terminated with ring tongue connectors, compression connections, or as required to meet Equipment supplier requirements.

(4) Polyvinyl chloride (PVC) jacket is not acceptable for any cable construction.

(5) Cable furnished shall conform to the cable descriptions as shown below:

(a) Low Voltage Power: 600 V, single-conductor, Class B stranded copper; EPR or XLP insulated; CPS, or CPE jacketed.

(b) Low Voltage Power: 600 V, three-conductor; concentric lay, stranded copper with a ground wire in the interstices; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall.

(c) Control: Control cable, 600 V, multiple-conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple-conductor, XLP insulation; CSP, or CPE jacketed overall.

(d) Instrumentation: Instrumentation cable, 600 V, flame retardant single-and multiple-twisted pairs and triads, shielded instrument cable with individually shielded pairs, overall shield, and overall jacket; FRXLPE or FREPR insulation; CSP, or CPE jacketed overall. (Single pair or triad 16AWG, multi-pair or triad 18AWG).

(e) Lighting & Receptables: Lighting circuit runs totally enclosed in conduit, NEC Type RHH-RHW-USE with XLPE insulation for use in outdoor or unheated areas.

(f) Shielded Control: Control cable, shielded, 600 V, multiple conductor, as required, stranded copper, 10 AWG, 12 AWG, 14 AWG; multiple conductor, XLP insulation; CSP, or CPE jacketed overall.

6.10 Grounding

6.10.1 This section covers the minimum requirements for furnishing and installation of grounding Materials.

6.10.2 Project Substation grounding system shall be an interconnected network of bare copper conductor and copper-clad ground rods (ground wells maybe used instead of ground rods if dictated by the soil analysis).

6.10.3 System shall be designed such that Project Substation personnel are protected from the hazards that can occur as the substation grounding system provides the earth return electrode during power system phase to ground faults.

6.10.4 Contractor may perform ground resistivity testing prior to final design to determine ground analysis parameters. The ground resistivity shall be measured with the methods given in IEEE 81.

6.10.5 Station grounding grid shall be designed in accordance with the methods and recommendations of IEEE 80.

(1) Grounding system shall have adequate capacity to dissipate heat from ground current under the most severe conditions in areas of high ground fault current concentrations, with grid spacing such that safe voltage gradients are maintained.

(2) Ground conductors shall be sized for fault duration of 0.5 seconds and a single line to ground fault current that exceeds the system impact study results by 15%.

(3) Ground system shall be designed to comply with IEEE 80 requirements.

6.10.6 Bare conductors to be installed below grade shall be spaced in a regular pattern that is consistent with the grounding analyses. Each junction of the grid shall be bonded together by an exothermal welding process.

6.10.7 Grounding connections shall be made to fences and Equipment. Equipment grounds shall conform to the following general guidelines:

(1) Grounds shall conform to the NESC.

(2) All Equipment grounding connections shall be connected to the ground grid.

6.10.8 All Project Substation bus and Equipment support structures shall be connected to the station ground grid. Metal support structures in direct metallic contact with other metal structures do not require a separate grounding connection to the station ground grid.

6.10.9 Fences shall be grounded in accordance with the requirements of the NESC. Project Substation ground grid shall be extended 1-meter outside of the Project Substation fence. Project Substation fence shall be connected to the Project Substation ground grid.

6.10.10 Ground Grid Design

(1) The final conductor sizing, grid configuration, grid depth, grid spacing, and quantity of conductors for the grid is to be determined during detailed design.

6.10.11 Materials

(1) All grounding materials required shall be furnished new and undamaged in accordance with the following requirements:

(a) Rods

1. 3/4-inch 10-foot copper-clad standard type. Copper cladding shall be electrolytically bonded to the steel rod or bonded by a molten welding process. Cold rolled copper cladding is not acceptable. Ground rods shall be as manufactured by Blackburn, Weaver, or Owner-approved equal.

(b) Cable

1. Bare: Soft drawn copper, Class B stranding, ASTM BB.

2. Insulated: Soft drawn copper, Class B stranding with green colored polyvinyl chloride insulation, UL 83, Type TW, THW or THHN.

(c) Wire Mesh

1. Copper-clad, 6 AWG, 6-inch by 6-inch mesh spacing, copper weld or Owner-approved equal.

(d) Bus and Bars

1. Soft copper, cross section not less than 1/8-inch thick by 1-inch wide, ASTM 8187.

(e) Exothermal Welds

1. Molds, cartridges, materials, and accessories as recommended by the manufacturer of the molds for the items to be welded.

2. Cadweld heavy duty or Owner-approved equal.

3. Molds and powder shall be furnished by the same manufacturer.

(f) Flush Ground Plates

1. Cadweld B 162 Series, B 164 Series, or Owner-approved equal ground plates with NEMA hole spacing.

(2) All clamps, connectors, bolts, washers, nuts, and other hardware used with the grounding system shall be made of copper.

6.11 Control, Protection, and Metering

6.11.1 Contractor shall design and fully manufacture, test, and deliver the control and protection system at the Project Substation.

6.11.2 System shall include instruments, devices, panels, racks, protective relays, meters, switches, accessories, and wiring. Relay panels are to be installed in a Contractor furnished Project Substation control building.

6.11.3 For the control design, Contractor shall provide drawings sets for all relaying drawings including one-line drawings, three-line drawings, control panel arrangements, fabrication details, bill of materials, nameplate lists, DC control schematics, AC schematics, circuit schedules, auxiliary equipment schematics, wiring diagrams, index sheets, and legends. Drawings shall be provided in electronic format.

6.11.4 Each circuit shall have its own, Owner approved, revenue grade meter and revenue grade voltage and current sensing required to meet requirements for capacity test.

6.12 Labeling and Identification

6.12.1 Electrical equipment shall be labeled to meet applicable safety codes and requirements.

6.13 Electrical Equipment Enclosures

6.13.1 Control cabinets, pull boxes, and junction boxes shall be in accordance with NEMA standards and shall be suitable for the location conditions. Base design shall be as follows:

(1) Indoor: NEMA 1

(2) Outdoor: NEMA 3R or 4

6.13.2 All enclosures shall be provided with pad locking provisions.

7.0 MECHANICAL

7.1 General Requirements

7.1.1 This section provides requirements for major Project Substation mechanical Equipment, mechanical systems, and mechanical interfaces with other plant systems and off-site facilities.

7.2 General Arrangements

7.2.1 Location of Equipment shall be based on safety, economics, ease of maintenance, and operation. Sufficient space shall be provided for maintenance of all Equipment including Equipment removal without excessive rigging or removal of surrounding Equipment.

7.3 Mechanical Systems and Equipment

7.3.1 Provisions shall be included in the design of all mechanical systems to allow the performance of all routine maintenance without requiring a plant shut down.

7.3.2 Contractor shall adhere to the following requirements:

(1) Receive, inspect, store, unload, maintain, erect, clean, align, and prepare all Equipment in accordance with Equipment manufacturer’s instructions before initial operation.

(2) Provide lifting lugs on all Equipment components or system components requiring removal for maintenance and weighing over 25 lbs.

(3) Select Materials of construction and design Equipment and systems to provide the specified minimum operating life at all operating conditions specified.

(4) Design the facility for the specified design life consistent with good engineering practice for BESS generation facilities. However, it is understood that some of the Equipment shall require routine maintenance and possible replacement during the life of the facility.

(5) Provide grounding lugs and ground all Equipment.

7.4 Fire Protection System

7.4.1 Contractor shall provide a complete fire protection system in accordance with the recommendations and requirements of NFPA, UL, FM, and the local AHJ. Systems shall receive the approval of the Owner's insurance carrier.

7.4.2 Engineer responsible for the fire protection system shall be a practicing fire protection engineer licensed in the jurisdiction of the Project. All drawings and specifications shall be signed and sealed by the licensed engineer.

7.4.3 Fire protection and detection system requirements for specific plant locations are summarized in Table 5-1.

7.4.4 Portable fire extinguishers shall be provided in all areas requiring handheld fire protection.

7.4.5 All local alarms shall report status to the SCADA System.

7.4.6 Fire walls for oil-filled transformers shall be provided between transformers and adjacent structures as required in accordance with NFPA 850.

7.4.7 General

(1) Fire protection during plant construction shall meet the requirements and recommendations of NFPA 241.

(2) All fire protection systems are subject to the review and approval of the local AHJ.

TABLE 5-1
Plant Fire Protection and Detection Systems

Plant Location	Type of Fire Protection	Fire Detection
Control building(s)	Handheld extinguishers*	Smoke/heat detectors
Transformer(s)	Fire walls if required by NFPA	Fire walls

*or as required by local AHJ

8.0 GEN-TIE LINE

8.1 General Provisions

8.1.1 This section shall form the technical basis for the design, material procurement, and construction of the Gen-Tie line between the Project Substation to POI.

8.1.2 New single or double circuit [ ] kV Gen-Tie line, to be installed on self-supporting tubular steel poles (or Utility/Owner approved structures), shall begin at the Project Substation, and terminate at the POI or Point of Change (POC) of ownership as defined in the interconnection agreement. In the event a new line is not required, the Project Substation interconnection shall still be required to comply with the Interconnection Agreement.

8.1.3 Contractor shall be responsible for the following:

(1) Perform Gen-Tie line engineering, analysis, and design.

(2) Prepare a complete construction package to include the following: final plan and profile drawings, sag charts, complete bills of material, structure staking table (and staking diagrams as needed), structure foundation drawings, structure erection drawings, insulator and hardware assembly drawings, right-of-way constraints, outage constraints with complete schedule, and construction technical provisions.

(3) Procure Equipment and Materials.

(4) Receive, inventory, store, and protect Equipment and Materials.

(5) Install the Gen-Tie line.

(6) Test and commission.

(7) Prepare "as-built" documentation, which shall include the gen-tie facilities, PLSCADD , .bak file, right-of-way widths, easement areas, fences and gates, and labeling of all major roads and points of interest in both AutoCAD and .pdf formats.

8.1.4 It shall be Contractor's responsibility to complete all tasks necessary to provide Owner with a complete and fully functional Gen-Tie line facility that meets all Owner's standards and specifications, including the interconnection agreement.

8.1.5 Contractor shall review and comply with all permit requirements and stipulations.

(1) Contractor to provide drawings for crossing agreements for entities in the right-of-way as required.

8.2 Engineering and Design

8.2.1 General Requirements

(1) Design specifications and drawing requirements provided or referenced in this document are to be considered as minimum requirements. Any criteria not specifically addressed in this Exhibit shall as a minimum meet or exceed the requirement of the current edition of the NESC C2 and local utility standards.

(2) Contractor shall use PLS-CADD software to spot and perform detailed analysis and design of the Gen-Tie line.

(3) Gen-Tie shall fit within defined right-of-way while adhering to all NERC and NESC regulations.

8.2.2 Survey

(1) Contractor shall establish a ground control network and collect controlled, color, digital, ortho-rectified photography, and terrain data as required for design beyond any Owner-supplied surveys.

(2) Contractor shall process the raw data and deliver a digital elevation model in a format readily imported into PLS-CADD.

(3) Contractor shall identify and obtain any additional survey data as required for Project design.

8.2.3 Geotechnical

(1) Contractor shall be responsible for obtaining any additional geotechnical data beyond the Owner-supplied geotechnical report as required for Project design.

8.2.4 Loading Conditions and Load Cases:

(1) For evaluation of existing gen-tie poles and design of new poles:

(a) Contractor shall apply the load cases and load factors appropriately for gen-tie poles according to NESC 250/local utility guidelines as applicable for tangent and dead-end structures.

(b) Maximum Deflection at the pole tip shall be limited to 1% of the total structure length.

(c) Structure shall be designed and analyzed for any combination of intact and/or dead-ended wires that result in the highest stress in the pole.

(d) Construction load case shall incorporate any and all loading conditions which may occur as a result of wire stringing and/or other construction activities.

8.2.5 Wire Design

(1) Tensions shall be limited to protect conductor against damage due to vibration.

(2) Stringing tensions for the OPGW shall not exceed 20% of the ultimate cable strength.

(3) Wire tension limits for design of the conductor, shield wire, and OPGW shall be based on applicable weather cases (wind, ice, temperature).

(4) Vibration protection shall be considered and provided as needed.

(5) Contractor shall consider and design all wire systems (OPGW, shield wire, and conductor) to prevent wire damage due to Aeolian vibration.

(6) Contractor shall incorporate manufacturer (wire and damper manufacturers) recommendations on drawing set and design.

8.2.6 Structure Loading and Electrical Clearances

(1) Contractor shall be responsible for wiring on the existing structures such that electrical clearance requirements are met and design loads are not exceeded.

(2) Calculation of the design loads is the responsibility of the Contractor.

(3) Electrical clearances to any unique crossings (i.e., railroad, wire, canal, etc.) shall be dimensioned out on the plan and profile drawings.

8.2.7 Phasing

(1) Phasing shall be verified in the field by the Contractor.

(2) Planned phasing shall be indicated on the Plan & Profile Drawings.

8.3 Material

8.3.1 Material shall be of new manufacture and unused and be free of defects and irregularities.

8.3.2 All assemblies, hardware, and components of assemblies shall be designed to meet the strength requirements of the most recent edition of NESC C2.

8.3.3 Contractor shall verify that all material, assemblies, hardware, and components of assemblies meet the strength requirements for the application and intended use.

8.3.4 Any piece of hardware in an insulator assembly shall at a minimum match the ultimate strength of the insulator.

8.3.5 Corona-free hardware shall be used and calculations shall be provided and ensure that complete testing is carried out to demonstrate that the insulator arrangements provide suitable arcing and corona performance.

8.3.6 Galvanized steel shield wire shall be 1/2 inch extra high strength (EHS) steel.

8.3.7 Optical ground wire shall be 96 fiber OPGW or as specified in the interconnection agreement/local utility guidelines.

8.3.8 If conductors are bundled horizontally, Contractor shall install spacers per conductor and spacer manufacturer's recommendations.

8.3.9 Mid-span spacers are not required for vertically bundled conductors.

8.3.10 Contractor shall be responsible for design of the jumper assemblies and riser structure framing such that all electrical clearances are maintained.

8.4 Construction

8.4.1 Contractor shall prepare, compile, issue, and update a construction specification for the Work described in this Exhibit.

8.4.2 Contractor shall procure material and construct the Gen-Tie line such that, when in operation, does not cause nuisance, audible noise or radio or television interference.

8.4.3 Contractor shall make all reasonable efforts to minimize all damages due to construction activities.

8.4.4 Contractor shall be responsible for preparing and acquiring crossing permits from the owners of any foreign overhead or underground facilities crossed.

8.4.5 Contractor shall be responsible for preparing and acquiring any construction access permits from the AHJ.

8.4.6 Contractor shall be responsible for preparing and acquiring all stormwater construction permits.

8.4.7 All temporary openings in fences created by the Contractor shall be removed and the fence repaired when access is no longer required. Contractor shall be held responsible for damage to crops, livestock, or other property resulting from failure to keep fences, gates, or fence gaps in proper condition.

8.4.8 Contractor shall be responsible for grounding all fences and structures along the Gen-Tie route.

8.4.9 Contractor shall repair and restore the right-of-way and clean up each structure location to the satisfaction of the Owner and the landowner/tenant. All earthwork, culverts, bridges, and drainage structures constructed by the Contractor shall be removed when no longer required.

8.4.10 All parts of the structure shall be purchased and installed by the Contractor.

8.4.11 Conductor, shield wire, and/or OPGW shall be installed in accordance with "IEEE Guide to the Installation of Overhead Transmission Line Conductors", Std. No. 524 and also adhere to approved local utility guidelines.

9.0 SECURITY PERFORMANCE GUIDELINES

9.1 Security Lighting

9.1.1 Basic security lighting shall be provided to assist in maintaining acceptable levels of facility protection. This includes, but is not limited to, lighting at entrance gates, employee entrances, building entrances, employee parking areas, and areas around the building perimeter.

9.1.2 Building security lighting shall be accomplished using a motion sensor and a photocell operated security light. The security light shall be located and installed on building exterior walls above all entrances. The motion sensor and photocell should be wired such that the motion sensor will not operate the light during the day. A light switch located inside the building shall be wired to override the motion and photo sensor.

9.1.3 Area lighting shall supplement existing street lighting to provide a maximum level of illumination from a minimum number of fixtures. The system shall be designed to illuminate the entire area evenly, including doorways, structures, and all opening into the structures.

9.1.4 Lighting shall be provided to cover the building faces evenly. Doorways and other openings in the building shall be lit to eliminate shadows.

9.1.5 Pedestrian and vehicle entrances that are actively used are to be provided with sufficient illumination to permit recognition of individuals and examination of credentials. All vehicle entrances shall be lighted so that the entire vehicle, occupants, and contents can be viewed. Doorways and other recesses shall be lit to eliminate shadows.

9.1.6 Contractor shall document security lighting requirements by providing a point-by-point, computerized photometric plan or other method that demonstrates that appropriate lighting has been planned.

9.1.7 Alternate circuitry shall be used in the power circuits so that the failure of any one lamp does not leave a large portion of either the site perimeter or critical or vulnerable area in darkness.

9.2 Building Utilities

9.2.1 To the extent possible, all utilities associated with the security performance requirements are to be run underground.

9.2.2 All circuits shall be run in conduit.

9.3 Electronic Security System (Exterior Design)

9.3.1 The exterior security system encompasses the required exterior lighting and fencing with top guard as well as all exterior electronic security equipment (i.e. access control, intrusion detection, and CCTV).

9.3.2 When the electronic system is required there shall be sufficient lighting throughout the site so that the cameras can operate effectively and record the required information. The electrical and the security system architect or engineer shall coordinate their efforts. If there are areas of concern (e.g., lack of or limited coverage), alternatives or additional camera locations shall be approved by Owner.

9.4 Security CCTV System

9.4.1 Security CCTV system consists of CCTV cameras housings, video and power cable, control panel, switchers, multiplexers, monitors, and recorders. System shall be designed so that it is capable of recording and being monitored 24 hours per day, 7 days per week.

9.4.2 Security cameras shall provide a color picture, have an automatic iris and pan-tilt-zoom (PTZ) control lens, and, if for exterior use, installed in environmentally controlled, domed housings. Domes shall be designed to eliminate the ability to observe the camera operation and location from inside the dome.

9.4.3 Entire substation area shall be covered by the CCTV system without any areas being blocked or obscured by substation equipment and/or structures. Entire exterior of the control building shall be covered without being blocked or screened by any equipment and/or structures.

9.4.4 Cameras shall be mounted on light poles when possible. Camera’s lens configuration shall be able to provide identifiable personnel images as well as read license plates and numbers. Separate camera coverage drawing showing camera placement as well as the focal distance and arcs for each camera shall be submitted to the Owner for review and approval.

9.4.5 CCVT System shall be provided with an operator interface in the control building.

10.0 TESTING, COMMISSIONING, AND PROJECT ACCEPTANCE

10.1 General Provisions

10.1.1 All commissioning and testing shall be coordinated with the Utility.

10.1.2 Contractor shall test, commission, start-up, and place into successful operation the Project Substation, including the electrical and communications infrastructure. All testing shall be performed by an independent, experienced third party and be in conformance with the following requirements:

(1) All Project Substation Equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

(2) All testing specified in the Applicable Standards, including NETA.

(3) All testing reasonably recommended or required by the applicable Equipment suppliers.

(4) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

(5) Insulation testing of all installed cables shall be as follows:

(a) 100% of all 34.5 kV cabling shall be Partial Discharge (PD) tested. In all cases, the tested sections shall include all cable sizes and shall test the terminations and splices (if any) on the selected cable sections. Test voltage shall be as a minimum 2.0 times rated voltage and at 60 Hz.

(b) 34.5 kV cable which has been in service shall not be hi-potential tested but shall utilize PD test methods per cable manufacturers recommendations.

(6) Point-to-point wiring checks of all installed wiring.

(7) After completion of wiring installation work, all circuits shall be tested for continuity, grounds, and shorts.

(a) After all sections of 34.5 kV testing are complete and individual circuits have been completely interconnected, each circuit shall be tested for circuit integrity using limited energy hi-potential DC or VLF testing at 100% operating voltage. This "proof" test shall be run to verify circuit integrity and to locate any grounds on the system related to construction or installation problems, while preventing equipment damage. Duration of the withstand test should be long enough for the voltage to stabilize but does not need to be longer than five minutes. One minute should be adequate in most cases. Test voltage shall not exceed 100% of the line to ground voltage (e.g., 20 kV for a 35 kV system).

(8) Project Substation foundations shall be tested for concrete and grout properties (strength, slump, air content, temperature).

(9) Compaction requirements as per the Project geotechnical report and its recommendations.

(10) Other testing set forth in the Contractor-provided Project Substation design documents.

10.1.3 Contractor shall notify Owner of all testing schedules in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner for review and approval.

10.1.4 Gen-Tie shall be tested per the applicable local utility, industry standards and practices.

ATTACHMENT 1 TO EXHIBIT A-2
APPLICABLE STANDARDS

Without limiting the information summarized herein, the purpose of this attachment is to summarize the applicable industry codes and standards for Contractor's Work.

A. General Requirements

1. Applicable Standards shall include (a) each of the standards and industry codes listed below and (b) each of the relevant standards and codes issued by the organizations listed below. For the avoidance of doubt, any standards or industry codes not identified herein but pertinent to the Work shall also apply.

2. Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the Applicable Standards including, but not limited to, those listed herein. Any departure from the referenced codes and standards shall be fully explained in writing and submitted for Owner's review and approval prior to implementation.

3. All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.

4. Any general standard or organization listed below shall be understood to include all relevant codes, standards, and/or guidelines under that particular standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.

5. Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

B. Applicable Standards

1. Publication Dates: Comply with standards in effect as of date of the Agreement unless otherwise indicated.

2. Applicable state requirements, including State Department of Transportation

3. Aluminum Association ("AA")

4. American Association of State Highway and Transportation Officials (AASHTO)

5. American Concrete Institute (ACI)

6. American Institute of Steel Construction (AISC)

7. American National Standard Institute (ANSI)

8. American Society for Testing and Materials International (ASTM)

9. American Society of Civil Engineers (ASCE)

10. American Welding Society (AWS)

11. American Wood Council (AWC)
12. Association of Edison Illuminating Companies (AEIC)
13. Avian Power Line Interaction Committee (APLIC)
14. Building Industry Consulting Services International (BICSI)
15. Code of Federal Regulations (CFR)
16. Construction Specifications Institute (CSI)
17. Electric Power Research Institute (EPRI)
18. Electrostatic Discharge Association (ESD)
19. ETSI European Telecommunications Standards Institute
20. Federal Aviation Administration (FAA)
21. Federal Communications Commission (FCC)
22. Illuminating Engineering Society (IES)
23. Institute of Electrical and Electronics Engineers (IEEE)
24. Insulated Cable Engineers Association (ICEA)
25. International Commission on Non-Ionizing Radiation Protection (ICNIRP)
26. International Council on Large Electric Systems (CIGRE)
27. International Electrotechnical Commission (IEC)
28. International Telecommunications Union (ITU)
29. Internet Engineering Task Force (IETF)
30. National Electric Code (NEC)
31. National Electrical Contractors Association (NECA)
32. National Electrical Manufacturer's Association (NEMA)
33. National Electrical Safety Code (NESC)
34. National Fire Protection Association (NFPA)
35. National Institute of Standards and Technology (NIST)
36. National Oceanic & Atmospheric Administration (NOAA) / National Weather Service (NWS)

37. National Rural Electric Cooperative Association (NRECA)
38. National Telecommunications and Information Administration
39. Occupational Safety and Health Administration (OSHA)
40. Regulations per the Commonwealth of PR (PREPA)
41. Research Council on Structural Connections (RCSC)
42. Rural Utilities Service (RUS)
43. Telecommunications Industry Association (TIA)
44. Underwriters Laboratories (UL)

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A-3

SCOPE OF WORK (BESS)

EXHIBIT A-3
SCOPE OF WORK (BESS)

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ATTACHMENT 1 – APPLICABLE STANDARDS

ATTACHMENT 2 – TECHNICAL SPECIFICATION

EXHIBIT A-3
SCOPE IF WORK (BESS)

1.0 EXHIBIT INFORMATION

1.1 Project Description

1.1.1 See Exhibit B-1 – Project Specific Information.

1.1.2 Supplier shall coordinate design with other engineering firms responsible for scope outside of this Agreement as set forth in Exhibit E–1 – Division of Responsibility

1.2 References

1.2.1 This Exhibit shall also be used in conjunction with Exhibit B-1 – Project Specific Information. This Exhibit and the documents in Exhibit B-1 – Project Specific Information are intended to supplement, but not necessarily duplicate, each other; any Work exhibited in one and not the other shall be executed as if it had been set forth in both. In the event of any conflicts between the information in Exhibit B-1 – Project Specific Information and this Exhibit, the more stringent requirement shall prevail.

1.3 Definitions

1.3.1 Unless defined in this Exhibit, terms that begin with an upper case shall have the meaning defined in the Agreement.

1.3.2 For purposes of Exhibit A-3 through Exhibit A-5, Exhibit C-2, and Exhibit E-1 the following words shall have the respective meanings set forth below.

- "**AC**" or "**ac**" means alternating current.
- "**Agreement**" means the Term Sheet between Owner and Supplier to which Exhibit A-3 through Exhibit A-5, Exhibit C-2, and Exhibit E-1 are attached.
- "**AHJ**" means any Authority Having Jurisdiction for the BESS Project.
- "**Applicable Law**" has the meaning set forth in the Agreement.
- "**Applicable Permits**" has the meaning set forth in the Agreement.
- "**Applicable Standards**" means the minimum standards and industry codes by Supplier, including those set forth in Attachment 1 - Applicable Standards to this Exhibit.
- "**Auxiliary Loads**" means power consumption not directly associated with System Losses. These include but are not limited to EMS and other control systems, thermal management systems, communications equipment, and other miscellaneous equipment loads. The PCS auxiliary power requirements shall be included as a System Loss unless the PCS requires a separate auxiliary power feed (see definition of System Loss).
- "**As-Built Drawing**" means a complete set of drawings prepared by Contractor or a Subcontractor which accurately and completely represent the Work as constructed and installed.

- "**Battery Energy Storage System**" ("**BESS**") means the comprehensive energy storage system Equipment and Materials including the batteries, racks, purpose-built enclosures, cabling, power combiners, PCS including inverters and medium voltage transformers, collection system, and switchgear.

- "**Battery Management System**" "(**BMS**)" means an electronic system that manages a rechargeable battery (cell or battery pack), such as by protecting the battery from operating outside its safe operating area, monitoring its state, calculating secondary data, reporting that data, controlling its environment, authenticating it and/or balancing it.

- "**Balance of Plant**" ("**BOP**") means all supporting components and ancillary systems necessary for completion of Project, other than the BESS itself, including but not limited to auxiliary power distribution equipment and cabling, communication systems, foundations and support structures, and civil site development.

- "**Business Day**" means any day except a Saturday, Sunday, or a Federal Reserve Bank holiday in the state that the Project is located. A Business Day begins at 8:00 a.m. and ends at 5:00 p.m. local time.

- "**Calendar Day**" or "**Day**" means any day that begins at 12:00 a.m. local time and ends 24 hours later.

- "**Collection System Circuit**" means the permanent electrical and communications infrastructure required to transmit energy and performance and operating data between the BESS and the Project Substation, or to the EMS control panel as appropriate.

- "**Communications System**" means the networking and communications hardware and software (including switches, routers, firewalls, patch panels) connecting the BESS, owner equipment, supervisory, control and data acquisition system (SCADA), and dispatching hardware, as well as all communications cabling and supporting devices within the Collection System Circuits.

- "**Contractor**" means the person, firm, or corporation with whom the Owner has entered into the Agreement to deliver the engineering, procurement, and construction of the Project.

- "**DC**" or "**dc**" means direct current.

- "**DC-DC Converter**" means the electrical equipment that adjusts the DC voltage on the input terminal to match a specified output voltage.

- "**Energy Management System**" "(**EMS**)" refers to a controls system that is responsible for control and/or monitoring of equipment, including but not limited to battery contactor, PCS, breakers, fire protection, HVAC, and metering. EMS also reports real-time site data along with relevant predicted, historical, and/or calculated data to operator or other entity for dispatching of the BESS or other generation unit with or without Operator interference.

- "**Equipment**" means all of the parts, components, materials, apparatus, structures, tools, supplies, consumables, goods, and other items required or appropriate for a complete, fully-functional Project or that otherwise form or are intended to form part of the Work or the Project, *including* all materials, apparatus, structures, tools, supplies and other goods provided and used by Supplier for performance of the Work, but that are not incorporated into the Project.

- "**Failure Modes and Effects Analysis**" "(**FMEA**)" means a systematic, proactive method for evaluating a process to identify where and how it might fail and to assess the relative impact of the different failures, in order to identify the parts of the process that are in need of change.

- "**Gen-Tie**" means the interconnection line that connects the Project to the interconnecting utility's power transmission network as provided by Owner in Exhibit B-1 – Project Specific Information

- "**Hazard Mitigation Analysis**" "(**HMA**)" means the Failure Modes and Effects Analysis or other approved hazard mitigation analysis required by IFC and NFPA 855 to evaluate the consequences of various failure modes.

- "**HMI**" means Human Machine Interface and shall refer to the user interface for the Supplier, Contractor, Owner and operator to interface with the EMS.

- "**HSSE Plan**" means collectively the health and safety plan, the security plan, and the environmental plan.

- "**HVAC**" means heating, ventilation, and air conditioning.

- "**Hertz**", or "**Hz**" means hertz.

- "**IGBT**" means insulated gate bipolar transistor.

- "**Inverter**" means Power Conversion System.

- "**kV**" means kilovolts.

- "**kW**" means a measure of power as measured in kilowatts. If not specified it shall be assumed to be in Alternating Current (AC).

- "**kWh**" means a measure of energy as measured in kilowatt-hours. If not specified it shall be assumed to be in Alternating Current (AC).

- "**Main Power Transformer**" "(**MPT**)" means the main transformer located in the Substation required to change the voltage to match the voltage at the POI. A BESS facility interconnected at a distribution level voltage may not require an MPT.

- "**Materials**" means products substantially shaped, cut, worked, mixed, finished, refined, or otherwise fabricated, processed, or installed to form a part of the Work.

- "**Mechanical Completion**" means completion of the battery PBE, including documentation of installation and pre-energization checks in accordance with the instructions set forth in the installation manual and any checklists provided by the Supplier.
- "**SDS**" means Safety Data Sheet.
- "**MV**" means Medium Voltage.
- "**MW**" means a measure of power as measured in megawatts. If not specified it shall be assumed to be in Alternating Current (AC).
- "**MWh**" means a measure of energy as measured in megawatt-hours. If not specified it shall be assumed to be in Alternating Current (AC).
- "**NRTL**" means Nationally Recognized Testing Laboratory.
- "**NTP**" means Notice to Proceed.
- "**OEM**" means Original Equipment Manufacturer.
- "**Owner**" means Owner of the Project as provided in Exhibit B-1 – Project Specific Information.
- "**Owner's Representative**" means a person, firm, or corporation with whom Owner has entered into a separate agreement.
- "**Overbuild**" means the desired excess energy of battery, in MWh, to be built at the beginning of the Project life at the POI.

1.3.3 "**Performance Guarantees**" means minimum Project performance requirements to be achieved as described in Exhibit B-1 – Project Specific Information or as defined in the Agreement.

- "**Performance Testing**" means testing per the requirements set forth in Section 2.0 of Exhibit A-4 - Performance Testing Procedures (BESS).
- "**Performance Tests**" means the tests listed in Section 2.1 of Exhibit A-4 - Performance Testing Procedures (BESS).
- "**Performance Test Procedures**" means the procedures required to adequately perform the Performance Tests listed in Section 2.2 of Exhibit A-4 - Performance Testing Procedures (BESS).
- "**Performance Threshold**" means the minimum threshold required for a Performance Guarantee as set forth in Exhibit B-1 – Project Specific Information
- "**PLC**" means Programmable Logic Controller.
- "**Point of Interconnection**" "(**POI**)" means the point where the interconnection line connects to the interconnection facilities constructed as provided in Exhibit B-1 – Project Specific Information, or as otherwise defined in the Agreement.

- "**Power Conversion System**" "(**PCS**)" means a bi-directional AC/DC inverter typically combined with a step-up transformer, DC input connected to the battery system and AC output interconnected typically to the Project Substation or interconnection point. If not specified otherwise, the medium voltage step-up transformer shall be assumed to be included with PCS.

- "**Project**" means the Project name as provided in Exhibit B-1 – Project Specific Information.

- "**Project Site**" means the location of the Project as provided in Exhibit B-1 – Project Specific Information.

- "**Project Substation**" means the substation that connects the Project to the interconnection line and the interconnecting utility's grid. Note: Distribution level project may not have a traditional substation. Substation in this context may be interchangeable with POI as defined in the Exhibit B-1 – Project Specific Information.

- "**Purpose-Built Enclosure**" "(**PBE**)" means the weather-proof battery equipment enclosure that can contain battery modules, battery racks, BMS, and integrated thermal management system. Dependent on supplier it can also contain inverters and local fire detection and/or suppression.

- "**Requirements**" means the Specifications in Project Exhibits, battery energy storage industry practices, Applicable Law, Applicable Permits, Applicable Standards, Project Schedule, interconnection agreement, utility specifications, Equipment manufacturers' requirements, AHJ requirements, and other requirements of the Agreement.

- "**Round-Trip Efficiency"** "(**RTE**)" means the percentage of electricity put into storage that is later retrieved. Both discharge and charge losses shall be included in round-trip efficiency. For the avoidance of doubt, this shall include all charging and discharging losses including and through the batteries, PBE, rack/string cabling, DC-DC converters, combiners, PCS (including inverters and medium-voltage transformers), cabling, main step-up transformer, and the interconnection line up to the Point of Interconnection.

- "**RTU**" means Remote Terminal Unit.

- "**SOC**" means State of Charge.

- "**Specifications**" means those portions of the Agreement consisting of written technical descriptions of the Work, and covering the Equipment, Materials, workmanship and certain administrative details applicable thereto.

- "**Subcontractor**" means an individual, firm, or corporation having a direct contract with Supplier, Contractor, or any other Subcontractor for the performance of a part of the Work.

1.3.4 "**Submittal Schedule**" means the schedule for Supplier's delivery of submittals, as set forth in Exhibit C-2 – Submittal Schedule.

- "**Substantial Completion**" means the completion to the satisfaction of the Owner (or waiver in writing by Owner) per the requirements set forth in Section 4.12 of this Exhibit, or as otherwise defined in the Agreement.

- "**Supplier**" means the person, firm, or corporation with whom Owner has entered into the Agreement. For the purposes of this Exhibit, "Supplier" means Equipment Supplier.

- "**System Loss**" or "**System Losses**" means power consumed by cables, buses, PCS, transformers, and transmission lines. Supplier shall specify if System Losses are inclusive of battery losses. Supplier shall include PCS auxiliary power as a System Loss if no separate auxiliary power feed to the PCS is required or Supplier shall include PCS auxiliary power as an Auxiliary Load if a separate auxiliary power feed to the PCS is required (Supplier shall determine if a separate auxiliary power feed to the PCS is required).

- "**UPS**" means Uninterruptible Power Supply.

- "**Work**" means all actions, capital, contracts, labor, Equipment, and Materials necessary to construct the proposed Project (including operating the Project) to provide to Owner at the specified delivery point.

2.0 GENERAL SERVICES

2.1 General Provisions

2.1.1 Supplier shall provide a utility-scale Battery Energy Storage System (BESS) Project for the Owner at the specified power capacity and energy production.

2.1.2 Equipment shall be capable of operating safely and reliably in accordance with the terms and conditions of the Agreement, this "Scope of Work" and associated Exhibits.

2.1.3 Supplier shall design the Equipment in accordance with the Agreement and Requirements. Scope of Work shall consist of:

- Equipment design engineering, software models, and drawing packages for construction permitting, installation and "as-built" documentation.

- Equipment submittal documents to Contractor and Owner for integration into final Project design for approval. The submittal schedule is found in Exhibit C–2 – Submittal Schedule

- Pre-operational testing and startup, performance testing, and component equipment testing. Equipment commissioning and testing in accordance with these Exhibits and Supplier requirements, as approved by Owner.

- Operations and maintenance documentation and Equipment warranty documentation. Warranty information is found in Exhibit A-5 (*BESS Warranty*).

- The Project shall have minimum and maximum design temperatures as provided in Exhibit B-1 – Project Specific Information. While in the design temperature range, the Project shall meet the Performance Guarantees as outlined in Exhibit B-1 – Project Specific Information and Exhibit A-4 Performance Testing Procedures (BESS).

2.1.4 Applicable standards in Attachment 2 – Technical Specifications and Attachment 1 - Applicable Standards of this Exhibit shall be applied as applicable to BESS. Supplier shall provide all special tools, technical direction, and manufacturers' field services as necessary to Contractor for achieving Equipment operation.

2.1.5 Minimum design working life shall be as provided in Exhibit B-1 – Project Specific Information.

2.1.6 Initial overbuild and augmentation design shall be as provided in Exhibit B-1 – Project Specific Information

2.1.7 Supplier shall prepare, implement, and manage a detailed quality assurance plan that is specific to the Project and Project Site. This plan shall conform to the minimum requirements set forth in the Agreement and Requirements.

2.1.8 Supplier shall prepare and maintain a documentation list for the Project. This list shall include, at a minimum, a listing of all Supplier deliverables, per Exhibit C-2 Submittal Schedule, the status and revision number of each. The naming and labeling conventions for all Supplier deliverables shall be coordinated with and approved by Owner. The documentation list shall be updated by Supplier each time a new or revised drawing or document is issued, at a minimum, including identifying any open and/or pending submittals for review.

2.1.9 Supplier shall upload electronic copies of all Supplier Deliverables (including drafts and final) to a web-based document management site shared with the Owner, i.e. Dropbox, SharePoint, etc. Supplier shall use Owner's file sharing portal. If Owner does not have a file sharing portal, then Supplier shall be responsible for setting up the file sharing portal.

2.1.10 Supplier shall prepare and conduct comprehensive training of Contractor and Owner and its operations and maintenance personnel in the safe operation and maintenance of the Equipment. Such training shall cover, at a minimum, the BESS including, battery system, BMS, EMS, and PCS.

2.1.11 Supplier shall provide and deliver all applicable Equipment as outlined in this Exhibit to the Project Site.

2.1.12 Supplier shall provide their Health, Safety, and Environment (HSE) and Quality Assurance/Quality Control (QA/QC) corporate policies. If applicable, Supplier shall also provide their Experience Modifier Rate (EMR).

2.1.13 Supplier shall provide Long Term Service Agreement (LTSA) as part of this proposal. The LTSA shall describe:

- Operations.
- Maintenance.
- Extended warranties.
- Fixed versus floating costs.
- Capacity at the POI throughout the Project operational life.
- Performance guarantees.
- Battery degradation and associated degradation curves throughout the Project operational life.

- Augmentation plan, which shall include capacity at POI which shall consider the additional System Losses and Auxiliary Loads after augmentation, year(s) of augmentation, AC or DC augmentation strategy if not specified, Auxiliary Load sizing, and space constraints.

2.1.14 Spare Parts

- Spare parts and special tools required for complete installation and commissioning of equipment specified in this Exhibit shall be provided by the Supplier.

- Supplier shall provide a complete recommended spare parts list for the Project's electrical works for a two-year period. Such list shall include recommended quantities, part / model numbers, and nominal pricing for a two-year period including recommendations for storage.

2.1.15 Bid Form

- Supplier shall fill out and provide a completed copy of the attached Supplier Bid Form in native format.

2.1.16 NERC Weather Standards

- Equipment purchased with regards to the Agreement shall conform to the NERC standards related to "Extreme Cold Weather Preparedness and Operations", including but not limited to "Reliability Standard EOP-012-3" and any successor standards, all as defined in the NERC guidelines in the five (5) years following the purchase of such Equipment, Contractor shall cause, or shall require its Subcontractors to cause, such software and hardware updates to such Equipment required to achieve such conformance within a commercially reasonable timeframe (the "Cold Weather Update"). The Cold Weather Update work will not be eligible for a Change Order.

2.1.17 Cold Weather Considerations

- As the equipment provided by the supplier is subject to extreme cold temperatures as listed in the Exhibit B-1 – Project Specific Information, Supplier shall provide a cold weather package as a part of base scope and shall comply with the NERC Weather Standards in section 2.1.16 above.

2.2 Coordination

2.2.1 Supplier shall coordinate weekly update meetings with Owner. Meeting content shall include, but not be limited to submittals, RFIs, design updates, general project progress. Supplier shall prepare meeting minutes after each meeting. If EMS is being supplied through a subcontract, EMS supplier shall be involved in these weekly meetings as necessary. Refer to Exhibit E-1 – Division of Responsibility for additional coordination items.

2.2.2 Supplier shall actively coordinate the sequence of Work with Contractor and Owner to support the Project Schedule. For the avoidance of doubt, this shall include coordination with the Contractor's schedule for the delivery and commissioning of the BESS. Owner, and Contractor shall meet (a) on a weekly basis before BESS deliveries begin and (b) as required by Owner after BESS component deliveries begin; the purpose of such meetings shall be to coordinate schedule for delivery and commissioning of the BESS. On a weekly basis, a meeting shall be held to reconcile all demurrage and delays for all parties regarding deliveries and offloading of components.

2.2.3 Supplier shall coordinate their on-site support with the Owner, any other Contractors, and other entities, to facilitate proper support for testing and commissioning. This includes all requirements specified in each Section of the Agreement.

2.2.4 Supplier shall work with Contractor and Owner to schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

2.2.5 Supplier shall advise EPC Contractor on the installation of different components with other contractors to allow optimum accessibility for required maintenance, service, and repair.

2.2.6 Supplier shall make adequate provisions to accommodate items scheduled for later installation.

- Supplier shall make adequate provisions to accommodate items scheduled for later installation.

2.2.7 Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

2.2.8 Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

2.2.9 Supplier shall attend and actively participate in all BESS Mechanical Completion walk-downs with EPC Contractor.

2.2.10 Supplier shall have an on-site presence beginning at delivery of BESS Equipment and ending after commissioning.

2.2.11 The following construction coordination meetings shall be attended by Supplier:

Preconstruction Meeting

- A meeting led by the Contractor after Agreement execution to review items stated in the following agenda and to establish a working understanding between the parties as to their relationships during performance of the Work.

- Preconstruction meeting shall be attended by:

  (a) Representative(s) of Contractor.

  (b) Owner’s Representative(s).

  (c) Representative(s) of Supplier

  (d) At Owner's option, representatives of principal Subcontractors.

- Location of meeting:

  (e) To be determined, Supplier shall prepare for on-site visit based on Project Site amenities at time of meeting.

- Reporting:

  (f) Supplier shall review meeting minutes for correctness.

Construction Progress Meetings

- A progress meeting led by Contractor at least weekly and at other times requested by Owner. Owner Representative's, Supplier and Contractor shall be present at each meeting. Contractor or Owner may request attendance by representatives of Subcontractors, Suppliers, or other entities concerned with current program or involved with planning, coordination, or performance of future activities. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.

- Contractor and each Subcontractor represented shall be prepared to discuss the current construction progress report and any anticipated future changes to the schedule. Each Subcontractor shall comment on the schedules of Contractor and other Subcontractors and advise if their current progress or anticipated activities are compatible with that Subcontractor's Work.

- If one Subcontractor is delaying another, Contractor shall issue such directions as necessary to resolve the situation and promote construction progress.

- Location of meetings:

  (g) At Project Site.

- Reporting:

  (h) Supplier shall review meeting minutes for correctness.

3.0 STRUCTURAL WORKS

3.1 General Provisions

3.1.1 Supplier shall submit all design study, calculations, and simulation reports to the Owner. The Supplier shall prepare the following study reports:

- The Supplier shall provide live load, dead load, and collateral load calculations for all equipment and structural supports.

- The Supplier shall provide a seismic qualification report in accordance with the requirements of IEEE 693 or Owner-approved equivalent using site-specific seismic information provided in Attachment 2 – Technical Specifications for all Equipment provided under the Agreement including but not limited to the following:

  (a) PBEs

  (b) Batteries and battery racks

  (c) Step-up transformers

(d) Inverters

(e) DC/DC converters

3.2 Structural Loading

3.2.1 Supplier shall provide loading information according to the following information and in accordance with the locally adopted version of the IBC and ASCE 7 as modified by the applicable AHJ Local Additions and Addenda:

- Dead Loads

  (a) Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including permanent hung loads.

- Live Loads

- Snow Loads

  (a) Snow design data shall be as provided in Attachment 2 – Technical Specifications. Wind design data shall be as provided in Attachment 2 – Technical Specifications.

- Seismic Loads: Seismic load values from the final geotechnical report take precedence over those referenced below.

  (a) Seismic design data shall be as provided in Attachment 2 – Technical Specifications.

3.3 Equipment Foundations

3.3.1 Supplier shall provide drawings showing Equipment dimensions, system weight, support locations, anchoring details, location of center of gravity, cable entry locations, and lifting diagram.

3.4 Corrosion Protection

- In general, all exposed carbon steel surfaces shall be treated for corrosion protection, if applicable. Supplier shall design and specify corrosion protection systems in accordance with International Organization for Standardization (ISO) 12944, which shall include surface preparation measures, for the following conditions : Carbon steel is exposed to ambient environmental conditions.

- Refer to Attachment 2 – Technical Specifications.

3.4.2 Structural steel shall have a minimum ISO corrosivity category as provided in Attachment 2 – Technical Specifications.

3.4.3 Stainless steel and galvanized steel shall not be painted.

3.4.4 Corrosion protection for structural steel shall be designed for a Project life as provided in Exhibit B-1 – Project Specific Information.

4.0 BATTERY ENERGY STORAGE SYSTEM (BESS)

4.1 General Provisions

4.1.1 Supplier shall design and furnish the Project in accordance with the Agreement and Requirements.

4.1.2 Owner shall provide all relevant Project information in Exhibit B-1 – Project Specific Information.

4.1.3 BESS equipment shall be designed, constructed, and sited in accordance with applicable standards and codes including but not limited to UL 9540, NFPA 855, IFC, other applicable local AHJ requirements, and as required by the approved Hazard Mitigation Analysis (HMA) based on large scale fire testing performed in accordance with UL 9540A.

- The HMA shall be provided to the Owner and AHJ for review and approval.
- PBE hazard mitigation systems shall be designed based on the data generated by the UL 9540A fire and explosion testing.
- Where there is a conflict between the codes and standards referenced above, the most restrictive shall govern unless otherwise approved by AHJ.

4.1.4 BESS shall be rated for the MWac and duration (or MWh) as provided in Exhibit B-1 – Project Specific Information measured at the POI. This measurement should be net of any System Losses and Auxiliary Loads unless otherwise specified in the performance acceptance test. The POI requirements shall be met for the entirety of the Project life starting at Substantial Completion.

4.1.5 Supplier shall provide battery degradation curves and a capacity guarantee for the Project.

4.1.6 Supplier shall size the BESS in order to comply with applicable regulatory requirements at the POI.

4.1.7 Owner shall provide to Supplier the final POI location and associated metering to meet the intent of these Specifications, the Scope of Work defined in this Exhibit, and the intent of the overall application.

4.1.8 BESS, composed of all Equipment and Materials, shall be fabricated and assembled to the maximum extent to allow for turnkey shipping and installation. Supplier shall identify all Equipment and Materials not fully assembled or installed that require field assembly by Contractor.

- Supplier shall furnish all labor, equipment, and materials that are necessary for a complete, fully functional, and safe BESS.

4.1.9 Supplier shall design the system such that the total RTE, measured from the Point of Interconnection (POI) to the battery to the POI, shall be as provided in Exhibit B-1 – Project Specific Information. In addition, refer to ATTACHMENT 2 – Technical Specifications, and Exhibit A-4 - *Performance Testing* Procedures (BESS).

4.1.10 Efficiencies and losses (real and reactive) associated with the batteries, PCS, DC/DC converters, and cabling in between shall be determined by the Supplier and provided in the proposal. Auxiliary power shall be determined by the Supplier and included in sizing. Any assumptions for losses outside of the Supplier's scope shall be provided.

4.1.11 Design, manufacture, test, package, and deliver all BESS Equipment and Materials in accordance with the requirements of the Agreement. The Equipment and Materials include but are not limited to the following which are listed for Owner's convenience in understanding the scope of the Work. Proposals shall identify and provide all other additional equipment necessary for a fully functional BESS and overall plant to meet the nameplate POI requirements. Supplier to provide PSS/E, TSAT and PSCAD models of their proposed modules for use in verifying that the POI rating is met.

- System design, manufacture, delivery, and commissioning of BESS, inverters or prefabricated PCS(s), DC/DC converters, all controls, thermal management system, UPS, and all structures required to house the BESS, inverter and related equipment.
- EMS system as specified in this Exhibit.
- Short circuit model of the BESS in Aspen OneLiner (.OLR) format which supplies equivalent Thevenin impedances and maximum per unit fault current time curves.
- The proposal shall include, but not be limited to, engineering, design, fabrication, testing, packing, delivery, startup, commissioning, and performance acceptance testing including model verification testing of the overall BESS.
- Supplier shall provide field personnel and support to the Project Site from equipment delivery to the completion of commissioning.
- The Equipment and Materials furnished under the Agreement shall be designed for outdoor installation and outdoor storage.
- All other accessories needed for a fully functioning system.

4.1.12 All Work shall be designed to meet the requirements specified in the Agreement and Requirements herein.

4.1.13 All Equipment and Materials shall be fabricated into shippable modules and/or enclosures to the maximum extent possible to minimize field installation and labor.

4.1.14 BESS shall be provided with a UPS designed to maintain critical systems upon a primary power failure.

- Supplier shall provide a critical systems load list, i.e. cooling, control, explosion prevention, etc., for the BESS.
- During a primary power failure incident, the batteries shall not be permitted to be charged or discharged; however, the thermal management system shall still be required to maintain adequate temperatures and provide battery cooling if the failure occurs during a charge or discharge scenario.
- Critical systems shall include but not necessarily be limited to explosion control, BMS, EMS, and thermal management system. Fire alarm system shall be furnished with separate secondary power supply as required by NFPA 72 and as specified below.
- UPS shall be adequately sized to provide power to the critical systems for a 2-hour duration.

4.2 Purpose-Built Enclosures (PBEs)

4.2.1 General

- PBEs and penetrations shall be designed and constructed to be wind resistant and shall be sealed to prevent infiltration of water, rain, snow, and dust when the doors are closed. PBEs shall meet or exceed the NEMA/IP rating as specified in Exhibit B-1 – Project Specific Information.
- Walk-in type units are not permitted. All equipment and components requiring testing, service, and maintenance shall be accessible externally.
- PBEs shall meet the design requirements and site location requirements as specified in this Exhibit.
- PBEs shall be of noncombustible construction.

4.2.2 Thermal Management System

- Thermal management system equipment shall comply with all battery manufacturers' requirements for internal air temperatures, chilled water temperatures (if utilizing liquid cooled batteries), and module/cell temperatures. The thermal management system shall be adequately designed for the location of the project as specified in Exhibit B-1 – Project Specific Information.
- Thermal management system control circuitry for an air cooled or ventilation system shall include a smoke detector and fire suppression shutdown provision.
- Thermal management shall be able to accept read/write commands remotely through owner's system in order to troubleshoot, adjust system setpoints, and initiate ventilation in case of fire/smoke event to evacuate smoke.
- HVAC/Ventilation shall require interlock to the PBE's fire alarm system for shutdown.
- Inlet louver(s) shall be sized with a free area velocity of not more than 75% of the point of water penetration for the louver and shall include a wind driven rain louver or similar device. Inlet louver(s) to be located at minimum distance from obstructions and mechanical exhaust per local code and manufacturer recommended clearances.
- HVAC/ventilation design shall comply with applicable codes, local ordinances, and Contractor standards.
- Thermal management system shall require process flow diagram which clearly depicts air flow and control equipment.
- A computational fluid dynamic (CFD) model of the thermal management system shall be completed and submitted to Contractor to verify the system's effectiveness.

(a) An acceptable CFD model shall be accompanied by a summary report of the results that clearly communicates the results which shall include but not be limited to all parameters and inputs clearly called out and defined, air temperature results showing instantaneous maximum, minimum, and temperature differential requirements from battery OEM are met, air velocity and pressure results that exhibit sound fluid dynamic properties, a discussion of the scenario modeled and why this provides the best means for confidence that the system meets temperature requirements, and convergence results that show acceptable computation results within the model.

- Installation & Owners Manuals describing routine maintenance shall be provided along with Thermal Management design. The Supplier shall perform repairs or replacements for equipment that is not performing as designed.

- Final design calculations and drawings sealed by a Professional Engineer (PE) registered in the state where Project is located shall be provided that meet the ASHRAE temperature conditions and site design criteria as specified in Exhibit B-1 – Project Specific Information.

- HVAC and ventilation systems shall be adequately braced/anchored. Seismic forces shall be calculated per ASCE 7.

- HVAC Equipment and refrigerants in the system shall meet all 40 CFR Part 82 requirements for Ozone Depleting Substances.

- Refrigerant information, specifications, and quantities shall be provided to Owner.

4.2.3 Fire Protection & Explosion Control

- An Emergency Management Plan shall be included as well as training for local fire authorities to outline hazards and recommended actions in the event of a fire.

- Supplier shall include the design and furnishing of a complete fire protection system that conforms to national and local codes.

- Fire protection and explosion control systems shall be designed for specific battery technology hazards demonstrated by UL 9540A tests; as required by applicable standards/codes including UL 9540, NFPA 855, NFPA 72, IFC, and any other AHJ requirements; and as a result of the HMA.

- PBEs shall be equipped with a UL-864 listed fire alarm control panel to power, monitor, and control initiating devices, notification devices, release devices, and any other emergency control functions in accordance with NFPA 72.

(a) PBEs shall be equipped with smoke detection or radiant energy sensing systems in accordance with NFPA 72, unless otherwise approved by Owner and AHJ.

(b) All required annunciation means shall be located as required by the AHJ to facilitate an efficient response to the situation.

(c) Fire alarm control panels shall be fully addressable and capable of fiber optic networking to allow for alarm signals from detection systems to be transmitted to a supervising station in accordance with NFPA 72.

(d) All fire alarm devices shall be addressable. Refer to Section 4 and 5 of ATTACHMENT 2 – Technical Specifications *(Fire Protection)* and *(Communications Shelter).*

- PBE shall be equipped with explosion prevention system designed in accordance with NFPA 69 or deflagration venting installed in accordance with NFPA 68, unless otherwise approved by Owner and AHJ based on fire and explosion testing and a deflagration hazard study.

  (a) Explosion prevention systems designed in accordance with NFPA 69 shall be designed to activate the combustible gas concentration reduction system upon detection of flammable gases at no more than 10% of the LFL of the gas mixture or of the individual components.

  (b) Gas detection system and combustible gas concentration reduction system shall be provided with a minimum of 2 hours of standby power.

  (c) Gas detection system shall be provided with a minimum of 24 hours of standby power and 2 hours in alarm or as required by the HMA.

  (d) Gas detection system shall be monitored by the local fire alarm system and allow for annunciation at an approved central, proprietary, or remote station in accordance with NFPA 72.

  (e) Compartmentalization created by cold and hot aisle arrangements within the PBE shall be addressed in accordance with the following:

    1. For NFPA 69 designs, the performance of ventilation systems shall be independently verified for a thermal runaway event in either aisle/subcompartment.

    2. For NFPA 68 designs, the placement of explosion relief panels shall ensure that the explosion hazard is addressed for both hot and cold aisles/subcompartments.

    3. Gas detection system shall be designed to activate on detection of flammable gas in either aisle/subcompartment.

  (f) Protection design shall demonstrate that deflagrations are not propagated to interconnected or adjacent cabinets, PBEs, or rooms.

- Fire protection system and explosion control details and components shall be included in the proposal and be subject to Owner review and approval.

4.2.4 Electrical System

- Equipment arrangement shall be as indicated on drawings or Owner approved modifications as required by Owner. Working space, access aisleways, and means of egress shall comply with NEC, Life Safety Code, and Owner preferences. Any equipment relocations shall be coordinated with Owner.

- Grounding:

  (a) Except as otherwise indicated, provide electrical grounding and bonding systems necessary to comply with all applicable codes and standards. Provide an assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type of component product meets indicated requirements, selection is Supplier's code-compliance option. Where materials or components are not indicated, provide products which comply with NEC, UL, and IEEE requirements and with established industry standards for those applications.

  (b) Connect each battery rack from the battery OEM specified rack grounding location to the ground bus with a conductor compliant with Applicable Standards.

  (c) Copper ground pads configured for NEMA two-hole connectors shall be provided on two opposite, non-adjacent corners of the PBEs on the exterior of the PBE.

- Lighting:

  (a) Interior Lighting:

    1. Provide PBEs with UL-listed twin tube, rapid start, LED lighting fixtures that are 120VAC controlled via three-way wall SPST switches to be located at each entry/access door so that the light fixture comes on automatically when the door is opened.

    2. Design interior light levels to provide a minimum 30 foot-candles of light the full length of the front of the battery racks and at working height for other equipment.

  (b) Receptacles:

    1. Provide one (1) 120VAC power strip mounted to the rear of the communication/telecom rack with sufficient duplex type receptacles for all telecom equipment in the rack.

  (c) Supplier shall not use wire smaller than No. 12 AWG.

  (d) Size and install proper wire size, as required, such that the voltage drop from the power or lighting panel to the farthest luminaire or receptacle does not exceed 3%.

- Provide the following equipment/systems:

  (a) DC Ground Fault Detection:

1. Supply, install, and connect a DC ground-fault monitor measuring across the DC bus at the main DC disconnect using a ground-reference module, or Owner approved equal.

(b) Temperature and Humidity Sensors

(c) Emergency Stop

(d) PLC System for HVAC and auxiliary BESS systems:

1. Provide Owner the opportunity to witness testing of the PLC logic and provide report summarizing the results.

2. Provide O&M manual for PLC system that includes full logic diagrams and schematics.

(e) UPS:

1. UPS supply sized to operate PLC, BMS, 24VDC, network switch, and server computer for minimum of 120 minutes and as required by the battery OEM for a controlled shut-down sequence. Supplier to size UPS to meet backup power & duration requirements defined by battery OEM to meet warranty terms, including required data collection.

(f) Auxiliary power supplies:

1. Supplier shall specify all Auxiliary Load power requirements to the Owner and Contractor. Contractor shall properly size all distribution equipment to meet the Auxiliary Load power requirements.

2. Supplier shall provide low voltage distribution equipment internal to the PBEs necessary for Auxiliary Loads.

3. Contractor shall provide primary and backup external power auxiliary power feeds at the voltage levels specified by Supplier.

4. Supplier shall provide the following Auxiliary Load information to the Contractor:

a. Total connected Auxiliary Load.

b. Total peak Auxiliary Load at maximum ambient design conditions as provided in Exhibit B-1 – Project Specific Information (charge, discharge, and rest/idle).

c. Total peak Auxiliary Load at 25˚ Celsius (charge, discharge, and rest/idle).

d. Total peak Auxiliary Load at minimum ambient design conditions as provided in Exhibit B-1 – Project Specific Information (charge, discharge, and rest/idle).

e. Average Auxiliary Load based on 365 annual cycles.

4.3 Batteries

4.3.1 Battery Requirements:

- Battery system shall be a proven technology that can meet the capacity requirements at the POI under all ambient conditions throughout the project life. Battery shall have proper protection and coordination with the inverter.

- Battery shall consist of lithium-ion cells of proven technology designed for the type of service described in this Exhibit. For the purposes of this Specification, proven technology shall be defined as cells that have been in successful commercial service in similar type applications for a period of time sufficient to establish a service life and maintenance history. Only cells that are commercially available or for which suitable (not necessarily identical) replacement cells can be supplied on short notice throughout the project life shall be allowed.

- Battery system shall be listed to UL 1973 and the battery manufacturer shall provide UL certificate prior to shipment to Project Site.

- Battery information and specifications shall be included in the proposal. This information shall include but is not limited to battery chemistry, battery datasheet, and MSDS.

- No part of the BESS shall have any exposed live parts in the PBEs. All busbars, terminals, switches, etc. shall have permanent, non-conductive covers to protect personnel from shock hazards during inspection and maintenance.

- Modules shall have cable terminations utilizing manufacturer provided quick disconnects or allowing for NEMA standard connections. Any cables provided by manufacturer shall be sized in accordance with NEC Article 310.

- Modules shall be designed to be easily inserted and removed from the battery rack. This may include non-tooled locking mechanisms, handles or lifting points, and/or track sliding.

- BESS shall be UL 9540 listed. Provide documentation indicating compliance with UL 9540 with proposal.

- The BESS shall be tested at the cell level for UL 9540A and at the module, unit, or installation level until it demonstrates acceptable performance criteria as specified in UL 9540A. Provide documentation of the UL 9540A test results and associated test reports with the proposal.

    (a) Installation configuration of the Equipment shall match the representative cell, modules, and units tested, including any optional integral fire suppression system.

- Battery subsystem as a whole and as individual cells shall be designed to withstand seismic events as described in this Exhibit.

- Battery system shall operate at a voltage no higher than allowed by the PCS or at 1500VDC, whichever is lower.

- Supplier shall provide information on the impact that weak or failed cells have on the life and performance of the entire string. The Supplier shall specify critical parameters, such as temperature variation limits between cells of a string. The Supplier shall provide a means of monitoring critical parameters to ensure the limits are being met.

- Cells, wiring, switchgear and all DC electrical components shall be insulated for 2000VDC.

- Supplier shall have overall responsibility for the safety of the electrical design of the battery.

- Battery system shall include a monitoring/alarm system and/or prescribed maintenance procedures to detect abnormal cell conditions and other conditions that may impair the ability of the Project to meet performance criteria. All alerts, including cyber alerts will be sent to appropriate personnel.

- BMS shall be capable of balancing the voltages across cells and modules automatically and independently without any input from the operator or the EMS.

- Cell monitoring system shall be specified to alert the proper personnel in a timely manner that an abnormal cell condition exists or may exist. Abnormal cell conditions shall include all types of cell failures that are commonly known to occur for the type of cell used.

- Monitoring/alarm system shall record data on the number and general location of failed modules, to expedite maintenance and cell replacement. This data shall be stored in non-volatile memory. Such monitoring/alarm system shall be integrated into the overall control system.

- Battery system shall include racks or shall consist of stackable modules. As applicable, the racks shall provide sufficient clearance between tiers to facilitate required module maintenance, including module testing, inspection, and replacement. Racks shall be secured against movement due to seismic activity.

- Rack-mounted modules shall have all connections located on the front of the PBE. Modules shall not be required to be removed from the racks during regular maintenance.

- All racks and metallic conductive members of stackable modules shall be solidly grounded. Racks shall be seismically qualified in accordance with IEEE 693 High Seismic Qualification Level and shall include means to restrain cell movement during seismic events. Rack anchorage and supports shall be designed for seismic events as described in this Exhibit.

4.3.2 Battery Usage

- See Exhibit B-1 – Project Specific Information for the planned use case(s) for the BESS annually to be included in degradation calculations. Any and all other restrictions to guaranteeing the capacity at the POI shall be included in the proposal. Supplier to provide with the proposal the impact in degradation if the operation of the BESS were to exceed the equivalent cycles per year as provided in Exhibit B-1 – Project Specific Information.

4.3.3 Battery Performance

- Supplier shall provide yearly performance curves or tables for battery modules & BESS system including, but not limited to, the following information for the Project life, accounting for degradation and in the case of (i) no LTSA/augmentation and (ii) with proposed LTSA/augmentation:

  (a) Energy Capacity.

  1. Expected shipped retention after delivery to Project Site.

  (b) Round-Trip Efficiency.

  (c) Charge/Discharge Rates.

  (d) Cycle Life/Energy Throughput.

  1. If the proposed lithium-ion batteries are sensitive to depth of discharge, the manufacturer shall state the limitations and the product shall be sized such that the limitations are included in the battery sizing.

  2. Base the degradation calculations on the specified planned use case for the BESS. Any and all other restrictions to guaranteeing the capacity at the POI shall be included.

  (e) Heat Loads.

  (f) Operating Voltage.

  (g) Self-Discharge.

  (h) Average State of Charge (ASOC) requirements.

  (i) Maximum and Minimum State of Charge (SOC) requirements.

  (j) Depth of Discharge (DOD).

  (k) Charge Losses.

  (l) Discharge Losses

- Supplier shall provide warranty information regarding cycling the BESS more than the equivalent cycles per year as provided in Exhibit B-1 – Project Specific Information.

- Curves and tables shall present performance data under multiple variables such as:

  (a) Ambient Temperatures

  (b) C-Rates

  (c) Cycle Life/State of Health (SOH)

  (d) Age of Battery

4.3.4 Battery Management System (BMS):

- BMS shall be capable of automatically balancing voltage levels at the cell, module, and string level as required by the battery manufacturer to optimize battery health.

  (a) Supplier shall provide documentation of how battery state of charge is calibrated over the Project life.

- BMS shall provide electrical and manual disconnects at the individual rack level and enclosure level. A manual disconnect for each string shall be provided with padlock provisions that prevents an automatic override of the disconnect.

- BMS shall provide both electrical protection and thermal protection for the battery modules in each string.

- BMS shall be included to manage the operational health of the Project and assure its safe, warranted, and optimal performance as an interconnected asset to Owner's electrical system. Primary functions include but are not limited to:

  (a) Monitoring

    1. State of Charge.

    2. State of Health.

       a. String.

       b. Module.

       c. Cell.

    3. Voltage/Current.

       a. String.

       b. Module.

       c. Cell.

    4. Temperature.

       a. Module/Cell Internal.

       b. Module/String Ambient.

       c. Module Internal Temperature Differential within a String.

    5. Status.

       a. Energy Throughput.

  (b) Charge/discharge management.

  (c) Balancing.

1. Cell voltage.
2. Module voltage.
3. String voltage.

(d) Warning and alarms.

(e) Internal protective measures.

(f) Logs of operations.

(g) Management of any software versions.

(h) Cybersecurity management of the device itself.

(i) Provide data exchange to the project SCADA.

(j) Contribute to functional safety of overall Project.

4.4 Controls

4.4.1 Supplier shall coordinate with Owner on guidance regarding system configuration, e.g. integration of the BESS/substation SCADA/EMS, jump server, firewall, connectivity, and related standards for the remote monitoring of the system.

4.4.2 BESS system shall include an EMS that interfaces with the individual components of the BESS to collect alarms, collect performance data, and to serve as an interface between the BESS and the SCADA system.

4.4.3 Battery Supplier shall procure, program, and commission the EMS.

4.4.4 EMS shall be able to communicate with Owner SCADA system via a standard protocol such as DNP3 via TCP or serial or as otherwise required.

4.4.5 EMS shall be able to communicate with the power dispatch entity via a standard protocol such as DNP3 via TCP or serial or as otherwise required by the Owner. Dispatch communication shall come from a single source.

4.4.6 EMS shall be capable of running completely automatically and without operator intervention.

- Upon loss of utility power interconnection or failure of utility power, restart of the instrumentation and control system to a standby state condition should require no local manual operations.
- Synchronization shall be performed automatically.

4.4.7 EMS shall include the following operating modes at a minimum, which shall operate automatically with no operator input:

- Real power (P) setpoint mode.
- Reactive power (Q) setpoint mode.

- Voltage (V) droop mode.
- Power factor (pf) mode.

    (a) System design shall be capable of a leading or lagging power factor at the POI while operating at the specified MW of charge or discharge at the POI, as provided in Exhibit B-1 – Project Specific Information.

4.4.8 Supplier shall coordinate with Contractor and Owner to provide an EMS that meets the requirements of PRC-028.

4.4.9 In addition to operating modes above, EMS shall provide any ancillary services specified in Exhibit B-1 – Project Specific Information at a minimum, which shall operate automatically with no operator input.

4.4.10 Additionally, EMS in combination with the other electrical equipment shall provide any other services specified in Exhibit B-1 – Project Specific Information at a minimum, which shall operate automatically with no operator input.

4.4.11 System and EMS shall meet all regulatory requirements as required by the owner.

4.4.12 EMS shall balance SOC across all BESS subcomponents.

4.4.13 EMS shall include the ability for an operator to take manual control of site and individual components. Operator shall be able to control site and PCS setpoints, open and close breakers and battery contractors, change operation modes, and fully start and stop equipment for maintenance and other purposes.

4.4.14 EMS shall include a fully operational historian for long-term and short-term storage of all site data. Historized data shall consist of all the following database points:

- Field inputs and outputs.
- Gateway inputs and outputs.
- Serial communication inputs and outputs.
- Internal composed, calculated, controlled, and monitored variables.
- Internal digital or logical points or data bits.
- Performance calculations, including data required to audit performance of EMS.

4.4.15 Historian shall include dedicated hardware and software for the historical data storage.

- System shall provide an alarm whenever the drive capacity exceeds 80% full.
- Historian shall be capable of storing three (3) years of historical data.
- Historian shall include data storage redundancy. No single drive failure shall result in loss of data.

4.4.16 Historical data shall be stored upon change of value or at a maximum of 1 second increments.

4.4.17 Historian shall be capable of online addition and definition of points without the loss of data.

4.4.18 Sampling of historical data shall be enabled or disabled without requiring addition or deletion of points and without disrupting the historical data storage function.

4.4.19 Historical data shall be exportable into readily available formats, such as Microsoft Access (.accdb) or Microsoft Excel (.xlsx).

4.4.20 Historical data shall be natively viewable in the EMS HMI or user interface.

4.4.21 EMS shall include capability of all monitoring and control to be performed via Owner-provided ISP connection. Operation of the EMS shall not require use of Internet or cloud-based functionality. Loss of networking shall not prevent EMS from continuing to operate the BESS.

4.4.22 EMS shall interface with the owner and provide and accept all required data to and from the power dispatch entity.

4.4.23 Design and installation of the EMS shall be provided with all hardware, telemetry, communication, and other requirements as required by the interconnection utility.

4.4.24 Communications System shall include the necessary equipment (hardware and software) for the exchange of signals with Project Substation equipment to support grid monitoring.

4.4.25 Communications System shall include the necessary equipment (hardware and software) for the exchange of signals and integration of any required reactive compensation devices (e.g., capacitor banks, reactors).

4.4.26 A register map containing all available parameters shall be provided to Owner. Any programming of the EMS necessary to implement the Owner's required dataset shall be included.

4.4.27 EMS design shall include configuration files and a comprehensive data points list and protocol specification for communications between all Project components requiring communications, data transfer, and control monitoring using the network integrated into the network. Such configuration files shall have the ability to be configured by Owner or Contractor, and Supplier shall furnish development application software for each configurable device.

4.4.28 HMI:

- EMS shall include an HMI viewable locally and remotely and allowing the monitor of all devices and control of all allowable functions.
- Supplier shall coordinate with Contractor to include equipment within scope of BESS HMI, including access to data and control of high voltage equipment.
- EMS shall be provided with the following supervisory screens, at a minimum:

    (a) Project Substation one-line diagram, including all breakers, switches and transformers and the real-time status of each (current, power, voltage, power factor, and reactive power, as applicable).

(b) Project Substation alarms and notifications, including status of all relays and status of all alarms and notifications.

(c) Main power transformer status, including the following for each main power transformer:

1. Operation and fault status, including alarms.

2. Relay statuses.

3. Temperatures, including winding and oil.

4. Tap changer position.

(d) Breaker status, including the following for each medium- and high-voltage breaker:

1. Operation and fault status, including alarms.

2. Relay statuses.

3. Breaker readings of current, power, and voltage, including the Collection System Circuit.

(e) BESS unit wide control functionality including the following:

1. Frequency Control.

2. Voltage Droop Control.

3. Manual/Local Control.

4. Remote/Auto Control.

5. BMS Control.

6. PCS Control.

(f) BMS control functionality including the following:

1. System start/stop/restart.

2. Operation and fault status including alarms, power limits, rack voltages, rack currents, and rack temperatures.

(g) PCS control functionality including the following:

1. System start/stop/restart.

2. Operation and fault status including alarms, and power limits.

(h) Balance of Plant status, including the following:

1. Operation and fault status, including alarms.
2. Enclosure alarms (fire/smoke alarm status, enclosure temperature, intrusion, explosion control system status, etc.).
3. UPS battery charger voltage and status.
4. Intrusion detection.
5. HVAC status.

(i) EMS status, including the following:

1. State of Charge, and Average State of Charge.
2. Dispatch program with a rolling view over 24 hours or as requested by Owner.
3. Customized screens for targeted key performance indicators on BESS operation.

- All major components (e.g., breakers, transformers, BESS) shall be listed separately.
- Alarms and faults shall be color-coded based on priority where applicable (e.g., green, yellow, red).
- Fault notification shall be provided through real-time text messaging or e-mail alerts, as determined by Owner. Fault notification messages and recipients shall be specified by Owner.

4.4.29 Testing

- Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.
- Provide entire Project Site testing to ensure proper operation of all data points into the component gateways and testing of all data points provided to third parties with that party.

4.5 Networking

4.5.1 General

- Supplier shall furnish all labor, equipment, and materials that are necessary for a complete, fully functional, and safe network configuration.
- Unused network ports shall be disabled. No wireless technologies are permitted unless specifically authorized and specified by the owner.
- Network shall be designed with data continuity and reliability as priority.
- Network shall be designed with redundancy so that there is no single point of failure to prevent control and monitoring of the BESS.

- All layer 2 network devices shall be connected to a layer 3 device. No daisy chain shall be allowed between switches.
- Network shall be designed to maintain a minimum of one (1) gigabit per second (Gbps) bandwidth throughout the backbone of the network.
- Owner shall give final approval of network design.
- Maximum propagation delay through the network shall be no greater than 500ms for control and 1 second for monitoring.
- Communications System shall be compliant with all Applicable Standards. Further, the Communications System shall comply and be designed to work in accordance with applicable system operator approved protocols, operating guides, standards, business practice manuals, and/or approved rules. Design should include parameters for operating under conditions specified by rules stated hereto as well as capability to function on an evidentiary basis.
- Network connected systems shall be segmented using network access controls such that only required communications for operation are permitted.
- Supplier shall provide a complete bill of materials of all control and networking equipment, including make, model, firmware version, operating system version, and where applicable IP address(es) and MAC addresses(es). Supplier shall allow Owner to provide a selected vendor and model.
- Supplier shall provide network diagrams that show all network cabling interconnections of all devices connected via an IP or serial protocol.
- Supplier shall provide network diagrams that show the communication between devices, including source, destination, port, media type, and protocol.
- Supplier shall provide complete configuration files or exports of all network communication devices.
- Supplier shall allow Owner to provide available IP network addresses for assignment.
- Supplier shall furnish and install all network and communication devices, including programming and configuration, necessary for the Communications System, excluding the programing of the Owner RTU equipment.

4.5.2 Security

- Network shall be designed per and adhere to Owner cybersecurity standards which shall be communicated by Owner during the bidding phase. Exceptions shall be formally obtained from Owner.
- Owner’s network shall be logically separated via firewalls from network where a 3rd party needs access.

- Firewalls or security gateways shall be placed between the supplied products and any external networks, including the Owner network and any remote access networks. The Communication System architecture design shall be non-linear such that networks are segregated.

- Supplied products which do not need to communicate with each other shall be placed on separate physical or virtual network segments. In case of virtual network segments, the configuration and enforcement shall be isolated to the layer two network equipment.

- All routing and switching devices shall supply SPAN ports for cybersecurity monitoring.

4.5.3 Network Cabling

- All communications cables, including fiber cables, shall be appropriately labeled with a permanently attached label at both ends. Labels shall be sequentially numbered.

- Fiber system shall be designed for a minimum of five (5) dB system margin.

- Network topology shall be designed such that the system utilizes redundancy to prevent outages due to cable or equipment failures.

- Maximum attenuation of fiber cabling shall be:

  (a) 0.35 dB/km at 1310 nm.

  (b) 0.25 dB/km at 1550 nm.

- Fiber type multimode (OM1/2/3/4) shall be submitted for Owner approval.

- Ethernet cabling shall follow TIA-568 standard and T568A pinout.

- Supplier shall provide 50% installed spares for fiber.

- Supplier shall terminate all spare fibers.

4.5.4 Submittals

- Supplier shall prepare configuration files and a comprehensive data points list and protocol specification for communications.

- Refer to Exhibit C-2 Submittal schedule for additional Communications System submittals.

- Supplier shall submit manufacturer's product sheets (material cut sheets) for all permanently installed equipment and materials.

- Supplier shall design, furnish, construct, and install the Communications System in conformance with the minimum requirements set forth in this Exhibit.

4.5.5 Testing and Quality Control

- Along with the Contractor, Supplier, shall test, commission, start-up, and place into successful operation the network, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall be in conformance with the following minimum requirements:

  (a) Communications cables shall be tested by Supplier where provided and installed by Supplier.

  (b) All network equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

  (c) All testing shall be performed as specified in the Applicable Standards, including NETA.

  (d) All testing shall be performed as reasonably recommended or required by the applicable equipment suppliers.

  (e) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

  (f) All fiber optic cable shall be visually inspected by Supplier prior to installation/termination.

4.6 Power Conversion Systems/Inverters

4.6.1 Provide inverters, disconnects, inverter master controller, and ancillary components of types, sizes, and ratings as required for the application, which comply with manufacturer's standard materials and with the design and construction in accordance with published product information. Where types, sizes, and ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.

4.6.2 Inverters shall be listed to UL 1741 when operated with standard settings. Provide grid-tie, bi-directional, utility interactive inverters with capabilities of voltage and frequency ride-through. The features shall be compliant with regulatory requirements.

4.6.3 Inverters shall have the capability of islanding and grid shaping operations as detailed in IEEE 1547.

4.6.4 Inverters shall be capable of Fast Frequency Response (FFR).

4.6.5 Inverters shall always recover and operate following any sequence of power cycles, such as recovering from voltage or frequency excursions.

4.6.6 Inverters shall have reactive power (VAR) control (4-quadrant inverter) that is capable of voltage regulation at the Point of Interconnection.

4.6.7 Inverters shall have dynamic power factor adjustment capabilities, via control system, such that the inverters at their AC terminals operate at the power factor at the POI as specified in Exhibit B-1 – Project Specific Information.

4.6.8 Dynamic power response shall be completely configurable based on pre-set capability curves (VAR vs kW, kW vs Hz).

4.6.9 Inverter shall have ground fault protection with capability to detect an earth fault, indicate that a ground fault has occurred, and automatically disconnect all conductors or cause the inverter to automatically cease serving power to the faulted circuits.

4.6.10 Inverter shall have DC insulation monitoring functionality in addition to ground fault protection. Provisions shall be in place for the insulation monitor to operate daily.

4.6.11 PCS/Inverter NEMA/IP rating shall be as specified in Exhibit B-1 – Project Specific Information.

4.6.12 The output shall be fused or protected by a circuit breaker to protect from overcurrent and to keep the loss of a semiconductor from causing a cascading failure. Inverter shall be supplied with an integrated DC load break disconnect for each inverter module to provide isolation, and an output AC circuit breaker to provide overall protection for the inverter. This circuit breaker shall be externally operated, capable of remote operation and be capable of lockout tagout.

4.6.13 The inverter shall have built-in protection against undervoltage, overcurrent, and overvoltage or transients. Inverter shall be provided with UL certified surge suppression devices on both the DC input and AC output.

4.6.14 Inverters shall meet IEEE 519 version 2014 for harmonic content. Total harmonic distortion (THD) of an individual inverter shall not exceed 2%.

- Non-fundamental-frequency current components, at any given frequency, injected into the system by the inverter(s) shall be less than the values specified below. The per-unit base is the rated current of the inverter when delivering the rated maximum real power at a power factor of 0.95 at nominal voltage. The RSS metric is the square root of the sum of the squares of the individual current frequency components from harmonic orders 2 to 50.

	Harmonic Order				
	h<17	17≤ h < 23	23 ≤ h < 35	35 ≤ h	RSS
Current Limit	2.0%	1.5%	0.6%	0.3%	3.0%

4.6.15 Current distortion specifications are applicable to all frequency components above 120 Hz and less than or equal to 3 kHz. Interpolation of the weighting factors shall be used for non-integer harmonics.

- Harmonic current limitations specified in this section apply to the currents caused by the inverter, not inclusive of harmonic currents caused by background harmonic voltages existing in the system exclusive of the inverters.

- Harmonic voltage limits

  (a) Resource shall not cause an incremental increase in voltage distortion at any non-fundamental order from harmonic orders 2 to 50 by greater than 1% of the nominal voltage.

  (b) Voltage TIF, as defined in IEEE-519, caused by the inverter(s), shall be less than 25.

(c) Voltage distortion specifications are applicable to all frequency components above 120 Hz and less than or equal to 3 kHz. Interpolation of the weighting factors shall be used for non-integer harmonics.

(d) These voltage distortion limitations apply to active contribution by the resource, and exclusive of voltage distortion amplification caused by resonances of passive circuit components.

4.6.16 Inverter shall have a short circuit withstand rating compatible with the battery system to which it is connecting.

4.6.17 Inverters shall be rated as 98% or greater efficiency at full load.

4.6.18 AC output shall not clip at any value below its nameplate while operating within the operating temperature range.

4.6.19 In the event of a grid failure or large disturbances, the inverters shall automatically disconnect from the grid. The inverters shall be capable of detecting an "islanding" situation by both passive (over and under voltage or frequency) measures and at least one active measure. Islanding function shall be capable of being disabled or turned off.

4.6.20 Inverter voltage and frequency ride-through capabilities shall be compliant with regulatory (NERC) requirements.

4.6.21 Inverter shall be provided with a front panel display. The display should provide read capability for all parameters and incorporate password-protected write capability. A cover shall be provided to protect the display from sunlight.

4.6.22 Inverter shall support bidirectional data exchange for EMS commands to the inverter. The controls shall be the manufacturer's standard package and shall include, but not be limited to, the following:

- Emergency power off.
- Emergency power off reset.
- Inverter on/off.
- Power factor control.
- Reactive power (VAR) control.
- Power output curtailment.
- Power and VAR ramp rate.

4.6.23 Inverter shall provide, at a minimum, the following data to the EMS:

- Inverter status, alarm states, faults and fault codes.
- Instantaneous input and output power.
- Energy production.

- DC and AC voltage.
- DC and AC current.
- DC current zone-level monitoring.
- Internal component and cooling system temperatures.

4.6.24 Inverter shall have a hard-wired emergency stop button on the external face of the inverter or on the exterior wall of the enclosure if the inverter is located indoors.

4.7 Medium Voltage Transformers

4.7.1 Supplier shall include a medium-voltage, liquid-filled transformer. Such transformer shall be sufficiently sized to allow the full battery array/PBE capacity to be delivered. Pad-mount transformers shall be in accordance with the requirements set forth in this Exhibit, at a minimum. Transformer must be approved by Minnesota Power.

4.7.2 Sizes and ratings as required by inverter selection and configuration.

4.7.3 Transformer(s) shall be manufactured to meet all special considerations and technical requirements as required by inverter supplier.

4.7.4 Liquid-Filled Transformers

- Shall comply with the following latest standards:

  (a) IEEE C57.12.00 - IEEE Standard for General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.

  (b) IEEE C57.12.10 - IEEE Standard Requirements for Liquid-Immersed Power Transformers.

  (c) IEEE C57.12.34 - IEEE Standard Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers.

  (d) IEEE C57.12.90 - IEEE Standard Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers.

  (e) NEMA CC 1 - Electric Power Connection for Substations.

  (f) NEMA TR 1 - Transformers, Step Voltage Regulators and Reactors.

- Pad-mount transformers shall be fitted with in-line, medium-voltage rated, current-limiting fuse protection per phase utilizing suitably rated, oil-immersed, current-limiting fuses. The selection of these fuses shall be such as to ensure (a) compliance with the requirements of IEC 62655 or ANSI/IEEE equivalent; (b) short circuit protection of the MV transformer winding; (c) that degradation of the fuses does not occur as a result of the flow of repeated transformer magnetizing in-rush currents; and (d) ease of replacement following an in-service operation.

(a) Equivalent medium-voltage circuit breaker protection may be used in place of current-limiting fuse protection.

- Pad-mount transformers shall be fitted with a low-side disconnect with visible open with means to take a BESS offline without taking an entire Collection System Circuit offline.

- Enclosure:

  (a) Pad-mount transformer shall include a fully enclosed, transformer mounted, MV and LV termination, steel cabinet, suitable for outdoor installation, as per IEEE C57.12.28. The cabinet shall be so designed as to fully enclose all cable tails, cable terminations, grounding tags and transformer fittings within a tamper and rodent resistant, secure enclosure.

  (b) Cabinet shall extend to floor level, fully shrouding all cable tails, having the facility for being directly bolted to the supporting pad.

  (c) MV and LV compartments shall be partitioned such that access to each compartment is via a separate door. External access shall be available through the LV compartment door only, with access to the MV compartment door lock being available within the LV compartment. The doors shall be fitted with an all steel, robust, tamper-proof, three point (i.e., top, mid, and bottom) integral locking system. Each door shall have the capability of being securely locked shut via the application of a dedicated pad lock.

  (d) Transformer nameplate and all transformer indication fittings (e.g., oil level indicator, oil temperature indicator) shall be located within the LV compartment, while all transformer operational fittings (e.g., tap changer switch, isolation switch etc.) shall be located within the MV compartment.

  (e) Cabinet doors shall be fitted with anti-close stays designed such that both doors can be held open at right angles. The anti-close stay design shall be sufficiently strong enough to withstand the prevailing wind conditions.

- Percent impedance voltage shall be according to the inverter manufacturer's recommendation, otherwise 5.75% ± 7.5%.

- Noise Level: Per NEMA Standards TR-1 (quote 55 dB as an option).

- Duty Cycle for energy storage application.

- Transformer shall be of the compartmental pad-mount design with dead front and loop feed features.

- Transformer kVA rating shall match or exceed PCS combined inverter rating at an equivalent temperature that meets project site design requirements. Impedance shall match inverter manufacturer requirements.

- Cooling class: KNAN or KNAF.

- Low voltage: Matched to selected inverter.

- High voltage: As specified in Exhibit B-1 – Project Specific Information.
- High efficiency: 99.2% or greater at nameplate output.
- No-Load losses shall be limited to 0.15% of full KVA rating.
- BIL ratings: To be stated in data sheet for Owner review.
- Winding insulation: 65ºC rise over 45ºC ambient.
- Number of windings: Maximum of three.
- De-energized tap changer with high voltage taps: two (2) 2.5% above and below nominal position, fully rated.
- Hook stick disconnect switch shall be located external to the transformer cabinet such that Arc Flash protection is not required for operation.
- Overcurrent and short circuit protection:

    (a) Selected to provide protection for the inverter step-up transformer, current carrying connections and conductors, and the inverter. Coordinated with the transformer damage curve to prevent damage.

    (b) Provided with short circuit, interrupting, and close and latch capabilities according to the definitions of IEEE C37.04 – IEEE Standard Rating Structure for AC High-Voltage Circuit Breakers, and meeting the requirements of IEEE C37.06 – IEEE Standard for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis – Preferred Ratings and Related Required Capabilities for Voltages Above 1000V. Provide ratings exceeding the available short circuit current of 30 kA or higher if determined by Supplier calculations and studies.

    (c) May consist of one of the following:

        1. Bayonet fuse (with holder) in series with partial range current limiting fuse, or

        2. Internal expulsion fuse in series with oil immersed current limiting fuse, or

        3. Electrically operated vacuum circuit breaker in a metal-clad construction according to the requirements of IEEE C37.20.2 – IEEE Standard for Metal-Clad Switchgear, or

        4. Electrically operated load interrupter switch meeting the standards of IEEE C37.20.4 – IEEE Standard for Indoor AC Switches (1 kV to 38 kV) for use in Metal-Enclosed Switchgear and in a metal-clad construction according to the requirements of IEEE C37.20.2 with current limiting fuse provided for short circuit protection, or

        5. Owner approved equal.

- Top powder coat of ANSI 70 light grey or other color as approved by Owner.

- Oil level, pressure/vacuum and oil temperature gauges. All instrumentation shall be read into SCADA. Oil temperature gauge to be furnished with two alarm contacts (warning and trip). Oil temperature and pressure transmitters shall provide binary outputs. Transformer shall have sudden pressure protection and associated output relay. Oil level gauge to be furnished with alarm contacts. Instrument gauges shall be located such that gauges can be read without requiring Arc Flash protection. Access to the Equipment shall be provided in accordance with NEC and OSHA standards.

- Drain valve with oil and dissolved gas analysis sampling provisions, readily accessible in normal operation. Valve shall be located external to the high voltage and low voltage compartments in a pad-lockable cover.

- NEMA 2-hole ground terminal pads.

- Transformer mounting pad design may be required to incorporate features for secondary containment of oil. Supplier shall conform to AHJ requirements and design shall be reviewed and accepted by Owner.

- Transformer insulating/cooling liquid shall be non-hazardous and environmentally friendly such as FR3 or Owner approved equivalent.

- In addition to all routine factory testing per most recent standard of ANSI/IEEE standard C57.12.90 and C57.12.00, the following tests shall be conducted:

  (a) Full ANSI impulse test on one (1) unit, preselected during production by Owner.

  (b) Heat run test on one (1) unit, preselected during production by Owner.

4.8 System Protection Requirements

4.8.1 Supplier shall coordinate with Contractor on protection relay design as indicated in Exhibit E-1 Division of Responsibility.

4.8.2 Protection and coordination for the "plant-side" system including batteries, DC combiner panels, inverters, AC combiner panels, transformers, auxiliary systems, and switchgear (where applicable) shall adhere to IEEE 242.

4.8.3 Protection relays for the interconnection shall be utility grade and shall meet the minimum requirements specified in IEEE C37.90 including requirements for EMI and surge withstand according to applicable standards for the intended location of the Project.

4.8.4 A complete protective relaying system based on industry standards shall be a part of the AC system. The protective relaying and metering shall be integrated with the Project control system and communications channel to Owner's SCADA system. However, integration into the Project control system shall not circumvent normal protective relaying functions.

4.8.5 All protective equipment and schemes shall be properly coordinated with the protection of the utility substation or distribution network protective devices where the Project is connected. Considerations for micro-grid or islanding applications shall be considered as required in Exhibit B-1 – Project Specific Information for protection scheme capabilities.

4.8.6 Supplier shall use microprocessor type protection equipment.

4.8.7 Low side bus and cable shall be protected by overcurrent or current differential relays.

4.8.8 All protective relays shall have functional testing completed on developed relay settings.

4.9 BESS Construction Support

4.9.1 Installation Support

- Supplier shall meet with Contractor and Owner prior to installation of the BESS to participate in an in-person page turn of the BESS integrated solution installation, including EMS.
- Supplier to provide offloading, storage, and erection instructions, including critical lift plans.
- Mechanical Completion of battery PBE, including documentation of progress on battery PBE Supplier-furnished forms, shall be successfully achieved in accordance with the instructions set forth in the installation manual and Mechanical Completion checklists provided by the Supplier.
- All rigging utilized for the transportation, offloading, or erection shall be rated, inspected daily, and load tested in accordance with Applicable Standards or other more rigorous requirements set forth in the HSSE Plan. Inspection reports shall be maintained at the Project Site and available for review by Owner.
- Copies of testing certificates and calibration records for all tooling shall be maintained at the Project Site and available for review by Owner.

4.10 Testing and Quality Control

4.10.1 Supplier shall test, commission, start-up, and place into successful operation the BESS, including the electrical infrastructure and communications infrastructure. At a minimum, testing shall be in conformance with the requirements defined in this Exhibit.

4.10.2 Factory Acceptance Tests: Supplier shall require the following equipment to be tested for functionality, operability, and performance in the factory and prior to shipment. The Owner or a Owner's Representative reserves the right to witness all tests. Supplier shall provide Owner with two weeks minimum notice prior to factory acceptance testing.

- Batteries
  - (a) Supplier shall provide manufacturing and testing schedule to Owner. Test plan shall be provided to Owner thirty (30) Calendar Days prior to test start for review.
  - (b) Test plan shall include energy capacity tests.
- Enclosures
  - (a) Supplier shall provide manufacturing and testing schedule to Owner. Test plan shall be provided to Owner thirty (30) Calendar Days prior to test start for review.

(b) Plan shall include evaluation of thermal management system and detection/suppression system.

- Inverters & Converters

(a) Supplier shall provide manufacturing and testing schedule to Owner. Test plan shall be provided to Owner thirty (30) Calendar Days prior to test start for review.

(b) Factory tests shall be performed according to manufacturer's standard recommendations and NEMA and IEEE Standards to ensure proper function and operation.

(c) Factory test reports shall be available upon request. Witness test shall demonstrate the following, at a minimum:

1. Run for a duration at rated current for burn-in equal to the BESS duration as specified in Exhibit B-1 – Project Specific Information.

2. Normal and failure mode operating sequence and protective functions.

3. Verification of accuracy of measured input/output voltage and currents.

4. Verification of dynamic power factor control via EMS (ex. Modbus).

5. Verification of power curtailment via EMS (ex. Modbus).

- MV Transformers

(a) Liquid-Filled Transformers

1. Minimum factory testing on all units unless expressly noted otherwise.

2. All tests identified as “routine” in IEEE Std C57.12.00 and performed in accordance with IEEE Std C57.12.90.

3. Resistance measurements of all windings.

4. Polarity and phase relation.

5. Ratio at rated voltage on all taps.

6. No-load losses and excitation current.

7. Load losses and impedance voltage.

8. Saturation characteristic/curves.

9. Positive, negative and zero sequence impedance for all windings .

10. Lightning impulse test on first unit produced.

11. Audible sound emissions on first unit produced.

12. Dissolved gas analysis on all units *prior* to temperature rise test.

13. Temperature rise test on first unit produced.

14. Dissolved gas analysis on tested unit *after* temperature rise test.

15. Dielectric tests.

16. Oil testing on all units shall be completed and approved by Owner *prior* to energization.

(b) Dry-Type Transformers

1. Dry-type transformers shall not be allowed unless previously approved by the owner.

- EMS Controls/HMI/SCADA

(a) Verification of performance: Compliance with specified criteria defined in this Exhibit, including any Owner cybersecurity requirements.

4.10.3 Requirements for the BESS functional testing shall be as follows:

- Equipment shall be tested for performance prior to commercial operation. This process shall verify the installed system is performing per the design.

- Supplier shall ensure manufacturer site acceptance testing is completed for inverters and battery enclosures with completed reports.

- Supplier shall ensure manufacturer Mechanical Completion checklists are completed for inverters and battery enclosures prior to energization.

- Supplier shall start up and commission each of the inverters and ensure they are running in the full DC voltage range for optimal performance.

- Prior to the performance test, the Supplier shall perform functional tests. As part of the commissioning process of the newly constructed BESS, the Supplier shall perform a functional test on each of the circuits to verify that they are all operating as expected and designed.

(a) As applicable, system software should be installed, updated, and confirmed operational.

(b) Verification of interconnected battery rack functionality.

(c) Safety system verification, confirming communication of smoke, gas, fire, heat, and other sensors and alarms with controls system, ensuring automatic emergency shutdown or ventilation as applicable.

(d) Verify proper and reliable electrical performance given environmental conditions and system DC power input per the Supplier recommendations.

(e) Confirm communications between cell, module, rack, and battery management system (BMS).

(f) Confirm communications between meters/monitors/sensors and the BMS as applicable.

(g) Compare and validate functionality against the factory acceptance test criteria for installation in the field, as applicable.

- Prior to the performance test, the Supplier shall perform Testing, Adjusting and Balancing (TAB), as well as functional testing on the thermal management system and ensure it is operating as designed.

  (a) TAB shall be performed and verified to be operating within design specifications.

  (b) TAB shall be performed by a Contractor that is certified by the Testing, Adjusting and Balancing Bureau (TABB).

  (c) Supplier shall develop a thermal management functional testing plan and execute tests to verify the thermal management system operates as designed. Functional testing of the thermal management system shall at the minimum do the following:

    1. Verify the control wiring, power wiring, is installed and operating as expected.

    2. Verify proper performance of all motors, actuators, dampers, valves and mechanical devices.

    3. Verify refrigerant piping has no leaks and system is adequately charged.

    4. Verify the system operates as designed and explained within the sequence of operations.

- Supplier shall verify proper meter operation and installation per manufacturer specifications. When open loop control is used, power losses from PCS terminals to the site meter at the medium or high voltage point, due to transformer losses, should be compensated by this calibration.

  (a) Verify proper wiring and installation per manufacturer specifications and/or design documents.

  (b) Verify proper current and voltage transformer (CT/VT) selection based on required accuracy classification.

  (c) Verify CT current readings are all the same to confirm orientation.

  (d) Verify proper CT & VT ratio programming into meter.

  (e) Verify meter date and time are set or linked to GPS clock.

  (f) Verify meter is accurately capturing and recording performance data.

  (g) Verify meter is properly communicating with EMS / SCADA system.

- Supplier shall perform an infrared scan to confirm site DC system health prior to conducting the performance tests. The Supplier shall perform repairs or replacements for each BESS that is not performing as designed.

- Supplier shall develop a testing plan and execute tests to verify functionality of all functions and operations.

    (a) Test plan shall be submitted for approval by Owner prior to commencement of tests.

    (b) Using the EMS / SCADA system, Supplier shall initiate commands to each PCS to evaluate proper functionality of each function and operating mode.

- Supplier shall develop and submit to Owner a test plan to clearly establish the scope of the testing for the fire alarm, signaling, suppression, and explosion protection system.

    (a) Supplier shall test fire alarm and signaling systems in accordance with NFPA 72 and local jurisdictional requirement to verify system operation in accordance with the design documents.

    (b) Supplier shall test fire suppression and explosion protection system in accordance with NFPA 72 and local jurisdictional requirements.

4.10.4 Requirements for the BESS performance testing:

- Supplier shall perform performance testing after Supplier verifies impedance calculations from the Contractor.

- Reference Exhibit A-4 - Performance Testing Procedures (BESS) for performance testing procedures and details.

4.10.5 Central inverter testing at the Project Site shall be performed in coordination with the inverter manufacturer field engineer. Testing shall include all testing recommended by the central inverter system manufacturer and testing required to maintain the central inverter system warranty. Any deviation from this requirement shall be approved by Owner. Testing shall confirm the inverter performance including power outputs, heat rejection, communications, etc. Copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within ten (10) Business Days of completing such test.

- Inverter manufacturer shall provide the following documentation from a certified NRTL:

    (a) UL 1741 Test Report.

    (b) UL 1741 Certification.

    (c) UL 1741 SA Test Report.

    (d) UL 1741 SA Certification.

    (e) IEEE 1547/519 Harmonics Test Report (including raw test data), current THD < 3 percent.

(f) NERC PRC-024-2 Voltage and Frequency Ride-Through Test Report.

- Inverter manufacturer shall provide the following documentation from type testing (or from a certified NRTL) to show the inverter meets the specifications outlined in the data sheet. The documentation shall include, at a minimum: active power, reactive power, frequency, DC voltage/current, AC voltage/current, and critical component temperatures (for ambient temperature testing).

  (a) Active Power

    1. Inverter manufacturer shall provide test documentation showing the inverter can operate up to the nameplate power rating (including any "overdrive" or 110% functionality).

  (b) Reactive Power

    1. Inverter manufacturer shall provide test documentation showing the inverter can operate up to the maximum reactive power capabilities.

    2. Minimum Requirement: As documented in the Interconnection Agreement or, at a minimum, 0.95 lead/lag in 0.01 intervals.

  (c) Plant Controller Response

    1. Inverter manufacturer shall provide test documentation showing the inverter can receive active and reactive commands from a simulated plant controller interface.

    2. Inverter manufacturer shall provide test documentation showing the inverter can operate at the maximum and minimum ramp rates for both active and reactive power variation.

  (d) DC Voltage

    1. Inverter manufacturer shall provide test documentation showing the inverter can operate over the rated DC voltage operating range.

    2. Inverter manufacturer shall provide active power vs. DC voltage de-rating curves.

  (e) AC Voltage

    1. Inverter manufacturer shall provide test documentation showing the inverter can operate over the rated AC voltage operating range.

    2. Inverter manufacturer shall provide active power vs. AC voltage de-rating curves from 0.9 to 1.1 p.u. terminal voltage and 0.9 lead/lag power factor.

  (f) Ambient Temperature

1. Inverter manufacturer shall provide test documentation showing the inverter can operate over the entire ambient temperature range (minimum duration to match BESS duration as specified in Exhibit B-1 – Project Specific Information at each test condition).

2. At a minimum, the test documentation shall include the following operating conditions: 25°C, 45°C, maximum operating temperature, minimum operating temperature, and any "corner points" on ambient temperature de-rating curves.

3. Inverter manufacturer shall provide active power vs. ambient temperature de-rating curves.

(g) Reliability

1. Inverter manufacturer shall provide test documentation summarizing the accelerated life testing (ALT) and highly accelerated life testing (HALT) that has been completed.

2. Inverter manufacturer shall provide mean time between failures (MTBF) and mean time to failure (MTTF) rates for critical components such as IGBTs, DC switches/contactors, AC contactors/breakers, DC link and AC filter capacitors, communications boards, and cooling system components (fans, pumps, etc.)

- At a minimum, the following tests shall be performed on each inverter during production testing:

(a) Calibration of all DC and AC voltage, current, and power circuitry/sensors.

(b) UL 1741 production testing such as hi-pot and PE/ground testing.

(c) Ground fault detector/interrupter (GFDI).

(d) Emergency stop (fast stop).

(e) Remote start/stop.

(f) Burn-in (minimum duration to match BESS duration as specified in Exhibit B-1 – Project Specific Information per inverter). Burn-in testing should be completed under elevated ambient temperature and high DC current conditions at maximum rated power.

(g) Harmonic content verification (during burn-in tests).

(h) Efficiency verification.

(i) Verify inverter efficiency at multiple DC voltages and power levels which shall be consistent with the levels tested during CEC testing.

(j) The official CEC test procedure is not required.

(k) Reactive power control range as documented in the Interconnection Agreement or, at a minimum, across a range of 0.95pu lead/lag.

(l) Voltage and frequency ride-through verification per IEEE 1547 and/or PRC-024-2.

(m) Single Phase Testing

4.11 Commissioning

4.11.1 Supplier shall test, commission, start-up, and place into successful operation the BESS, including the electrical infrastructure and communications infrastructure in accordance with IEEE 1547. Commissioning activities shall be executed under a phased approach, as identified below.

4.11.2 Design Phase

- Commissioning & Testing Plan: A project-specific Commissioning & Testing Plan shall be developed and issued by Supplier. The Commissioning & Testing Plan shall outline the proposed personnel and/or company, tasks, processes, procedures, and deliverables required to prove the function and performance of the Work. It shall include a section on deficiencies and resolution procedures for each phase and the Commissioning & Testing Schedule. The Commissioning & Testing Plan shall also reference safety requirements for start-up and commissioning, including electrical safety and lock-out/tag-out procedures. The Commissioning & Testing Plan shall be submitted to the Owner for review and approval.

- Commissioning Log: A detailed commissioning log shall be developed and issued by Supplier for the tracking of all commissioning activities, issues, observations, and deficiencies.

4.11.3 Construction Phase

- Meetings: Commissioning meetings shall be held on-site on a periodic basis. A commissioning kick-off meeting shall be held with the project team at the commencement of project construction. The commissioning kick-off meeting shall include Supplier's commissioning lead, project manager, design team representative, construction team representatives, and the Owner's Representative.

- Inspections: Equipment delivery inspections shall be carried out by Contractor during construction based on Supplier's installation and QA/QC requirements.

- Functional Tests and Inspections: Equipment-specific functional checklists shall be developed and implemented by Supplier. The functional checklists shall address proper installation methods, vendor/manufacturer requirements, applicable codes and standards, and design requirements. Functional testing and inspections shall be required as pre-requisite of Mechanical Completion, including the following:

  (a) Mechanical and electrical installation of the BESS, inverter, MV transformer, and MV switchgear as applicable including associated Supplier cabling per design drawings and equipment manufacturers' recommendations.

(b) Functional tests of the battery PBE, including batteries, BMS, thermal management system, explosion control, fire detection, and fire suppression systems as applicable and per manufacturers' requirements.

(c) Installation of the PCS skid equipment, including inverters, transformers, EMS, and auxiliary equipment per the design drawings and equipment manufacturers' requirements.

1. Inverter functional checks per inverter manufacturer requirements.

(d) Functional checks and tests of the MV transformers as required by NETA-ATS, including but not limited to megger tests, hi-pot tests, oil sampling tests, grounding tests, confirmation of tap changer settings, insulation resistance of open load break switch, insulation resistance of windings, and turns ratio testing.

(e) Verify that EMS Equipment is installed per design drawings and manufacturers' recommendations.

(f) Verify proper installation of all medium voltage fault indicators and surge arrestors.

(g) Inspect and test each low and medium voltage switch or breaker in accordance with NETA-ATS.

(h) Confirm all equipment is properly bonded to earth ground per NETA-ATS 7.13.

(i) Confirm all enclosures are clean and free of debris.

(j) Verify that all warning signs and safety labels are installed.

(k) Confirm proper settings of all adjustable trip circuit breakers.

- BESS shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

(a) As described in this and related Specifications.

(b) Continuity testing of all installed wire, cables, and bus.

(c) Megger all power cables and bus.

(d) Power testing of all enclosure circuits (i.e. lights, receptacles, etc.).

(e) Functional testing of all HVAC and thermal management equipment.

(f) Functional testing of all fire alarm and suppression equipment and systems.

(g) Functional testing of DC Ground Fault Detection device.

(h) Functional testing of PLC logic.

- All testing specified in the Applicable Standards including NETA-ATS.

- Testing according to NERC MOD standards to ensure the response of the plant matches the rms and electromagnetic transient model response.

- All testing reasonably recommended or required by the applicable equipment manufacturers.

- All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

- EMS and communications system testing and commissioning in conformance with the following minimum requirements. Supplier shall notify Owner of all testing schedules at least thirty (30) Calendar Days in advance of testing activities and copies of testing reports (including a summary of testing procedures and acceptance criteria) shall be submitted to Owner within ten (10) Business Days of completing such test.

    (a) All Communications System line equipment shall be tested to demonstrate it meets stated design criteria and is fit for purpose.

    (b) All testing specified in the Applicable Standards.

    (c) All testing reasonably recommended or required by the applicable equipment manufacturers.

    (d) All exposed cable sections shall be visually inspected for physical damage or manufacturing defects. Such inspections shall be performed prior to and during installation.

    (e) Verify all alarms, indications and analog quantities are communicated and received properly by the RTU and displayed correctly on the HMI.

    (f) Verify all communication channels (intra- and inter-Project Substation), including Project Substation LAN, operate as expected.

    (g) Verify fiber optic system performance (power losses, splice, or connector losses, etc.) using OTDR. All such testing shall be done with an OTDR in both directions of the strands. For single-mode fiber, test both directions at 1310 nm and 1550 nm. A successful test result shall be (a) less than 0.35 dB per connection and (b) (i) less than -50 dB if UPC and (ii) less than -65 dB if APC.

    (h) All fiber optic cable / strands shall be visually inspected and OTDR-tested prior to installation / termination on every fiber run.

    (i) Provide system functionality and compatibility at the control room / O&M Building.

    (j) Provide entire Project Site testing to ensure proper operation of all data points into the component gateways and testing of all data points provided to third parties with that party.

4.12 Substantial Completion

4.12.1 The following are conditions required to achieve Supplier Substantial Completion:

- All requirements of Mechanical Completion have been completed to the satisfaction of the Owner.
- Successful functional testing of the BESS system, including:
  - (a) Capacity testing to achieve the project minimum guaranteed capacities as indicated in Exhibit B-1 – Project Specific Information.
  - (b) Demonstrated operation of the EMS.
- All Supplier submittals have been received and approved to Owner's satisfaction.
- Supplier has delivered all applicable lien waivers to Owner.

ATTACHMENT 1 TO EXHIBIT A-3
APPLICABLE STANDARDS

Without limiting the information summarized herein, the purpose of this attachment is to summarize the applicable industry codes and standards for Supplier's Work.

A. General Requirements

1. Applicable Standards shall include (a) each of the standards and industry codes listed below and (b) each of the relevant standards and codes issued by the organizations listed below. For the avoidance of doubt, any standards or industry codes not identified herein but pertinent to the Work shall also apply.

2. Unless otherwise specified, all engineering, procurement, and construction associated with the Project shall comply with the applicable codes and standards including, but not limited to, those listed herein. Any departure from the referenced codes and standards shall be fully explained in writing and submitted for Owner's review and approval prior to implementation.

3. All specific standards applicable to pieces of equipment, structures, and/or buildings may not be listed herein. Specifications may describe the specific standards that may apply.

4. Any general standard or organization listed below shall be understood to include all relevant codes, standards, and/or guidelines under that particular standard or organization. For example, ACI shall include ACI 301, ACI 305, ACI 306, ACI 318, etc.

5. Unless otherwise specified herein, in the case of conflict between any Applicable Standards, the more stringent requirement shall apply.

B. Applicable Standards

1. Publication Dates: Comply with standards in effect as of date of the Agreement unless otherwise indicated.

2. Applicable state requirements, including State Department of Transportation

3. Aluminum Association ("AA")

4. American Association of State Highway and Transportation Officials ("AASHTO")

5. American Institute of Steel Construction ("AISC")

6. Association of Iron and Steel Engineers ("AISE")

7. American Iron and Steel Institute ("AISI")

8. American National Standards Institute ("ANSI")

9. American Society of Civil Engineers ("ASCE")

10. American Society of Heating, Refrigeration, and Air Conditioning Engineers ("ASHRAE")

11. American Society of Mechanical Engineers (“ASME”)
12. American Society of Nondestructive Testing (“ASNT”)
13. American Society of Testing and Materials (“ASTM”)
14. American Water Works Association (“AWWA”)
15. American Welding Society (“AWS”)
16. Code of Federal Regulations (“CFR”)
17. Crane Manufacturer Association of America (“CMAA”)
18. Department of Transportation (“DOT”)
19. United States Environmental Protection Agency (“EPA”)
20. Federal Aviation Agency, Department of Transportation (“FAA”)
21. Federal Communications Commission (“FCC”):
22. Federal Energy Regulatory Commission (“FERC”).
23. Federal Highway Administration (“FHWA”)
24. International Air Transport Association (“IATA”)
25. Illuminating Engineering Society (“IES”)
26. Institute of Electrical and Electronic Engineers (“IEEE”)
27. Instrumentation Society of America (“ISA”)
28. Insulated Cable Engineering Association (“ICEA”)
29. International Building Code (“IBC”)
30. International Fire Code (“IFC”)
31. International Electrical Testing Association (“NETA”)
32. International Electrotechnical Commission (“IEC”)
33. International Energy Conservation Code (“IECC”)
34. Illuminating Engineering Society of North America
35. International Maritime Organization (“IMO”)
36. International Safety Equipment Association (“ISEA”)
37. International Organization for Standardization (“ISO”)

38. Metal Building Manufacturers Association (“MBMA”).
39. National Electric Code (“NEC”)
40. National Electrical Contractors Association (“NECA”)
41. North American Electric Reliability Corporation (“NERC”)
42. National Electric Safety Code (“NESC”)
43. National Electrical Manufacturers Association (“NEMA”)
44. National Electrical Testing Association (“NETA”)
45. National Fire Protection Association (“NFPA”)
    a. NFPA 1 – Fire Code
    b. NFPA 68 – Standard on Explosion Protection by Deflagration Venting
    c. NFPA 69 – Standard on Explosion Prevention Systems
    d. NFPA 72 – National Fire Alarm and Signaling Code
    e. NFPA 855 – Standard for the Installation of Stationary Energy Storage Systems
46. National Safety Council (“NSC”)
47. Occupational Safety and Health Administration (“OSHA”)
48. Scientific Apparatus Makers Association (“SAMA”)
49. Steel Door Institute (“SDI”)
50. Sheet Metal and Air Conditioning Contractors National Association (“SMACNA”)
51. Society for Protective Coatings (“SPC”)
52. Telecommunications Industry Association/Electronic Industries Association (“TIA/EIA”)
53. Underwriter’s Laboratories (“UL”)
    a. UL 864 – Standard for Control Units and Accessories for Fire Alarm Systems
    b. UL 1741 – Standard for Safety Inverters, Converters, Controllers and Interconnection System Equipment for Use With Distributed Energy Resources
    c. UL 1973 – Standard for Safety Batteries for Use in Light Electric Rail (LER) Applications and Stationary Applications
    d. UL 9540 – Standard for Safety Energy Storage Systems and Equipment
    e. UL 9540A – Standard for Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

ATTACHMENT 2 TO EXHIBIT A-3
TECHNICAL SPECIFICATION

1 Contract Deliverables

1.2 Scope

1.2.1 These specifications outline the review and approval requirements for the Supplier deliverables. Supplier scope includes all documents in the specification.

1.3 Purpose

1.3.1 This Attachment defines the Supplier and Sub-Supplier deliverable to be submitted with the following information:

1.3.1.1 Schedule for the deliverable to be submitted to Owner.

1.3.1.2 Review/Approval requirements.

1.3.1.3 Format that the deliverable are to be submitted to Owner as addressed in Exhibit C-2 – Submittal Schedule.

1.4 Responsibility

1.4.1 The Supplier is responsible for submitting documentation in accordance with Exhibit C-2 – Submittal Schedule.

1.4.2 Owner is responsible for defining date of the award of the contract from which the document submittal dates are timed.

1.4.3 Upon receipt of the transmittal, Supplier shall allow ten (10) Business Days for Owner review and comment cycle for all documents and drawings unless otherwise indicated.

1.4.4 Owner reserves the right to review all documents and records produced by Supplier during each design phase and until Project Substantial Completion. Supplier shall respond in writing to all of Owner's comments.

1.5 Upon the owner's request, all personnel on site must submit to a background check. Refusal will result in being denied site access. Instructions

1.5.1 The review/approval matrices shall be used as the basis for submitting documents to Owner. Following is a definition of the codes associated with each document:

1.5.1.1 Issued for Owner Review (IFR): Supplier shall submit documents to Owner for review and approval and shall incorporate comments from Owner.

1.5.1.2 Issued for Information (IFI): Supplier shall submit documents to Owner for information only. (Owner reserves the right to comment).

1.5.2 Owner will, by a notice to Supplier, review the submittal to issue comments or indicate the acceptance or rejection of the documents per the agreed upon Deliverables Matrix. Owner review of and/or comments, or lack of comments to Supplier documents does not relieve Supplier of any Contract requirements.

1.5.3 Document Requirements

1.5.3.1 Supplier shall provide copies of Submittals as indicated in Exhibit C-2 – Submittal Schedule in compliance with the guidelines established within the document to ensure proper document control capabilities and seamless transfer of information to Owner.

1.6 General Requirements

1.6.1 This Section covers the scope of the services to be provided by the Supplier. Supplier shall perform all design work, including but not limited to the following items:

1.6.1.1 **Design Documents:** Prepare design documents, models, size equipment, generate drawings and specifications, and other supporting activities to the degree of detail required to fully and clearly define construction work requirements.

1.6.1.2 **Calculations:** Prepare calculations and models as required for design decisions, equipment and material selection, construction drawings preparation, and regulatory review and approval.

1.6.1.3 **System Descriptions:** Prepare system descriptions indicating equipment data, operating characteristics, design basis, functions, and other process information for:

1.6.1.3.1 PBEs

1.6.1.3.2 Inverters

1.6.1.3.3 EMS system

1.6.2 **Equipment Lists:** Prepare electrical, instrument, and mechanical equipment lists with summary descriptions, vendors, and pertinent data for systems defined in Exhibit A-3 – Scope of Work.

1.6.3 **Operation and Maintenance Manuals:** Provide O&M manuals of PBEs, Inverters, EMS system and any other supplier provided equipment as defined in Exhibit A-3 – Scope of Work. O&M manuals to include system description, equipment list, equipment data sheets, calibration certificates, warranties, and as-built drawings.

1.6.4 **System Startup & Commissioning Test Procedures and Reports**: Startup and commissioning test procedures and reports, and test protocol shall be prepared for all systems in accordance with Exhibit A-4 – Performance Testing Procedures (BESS). Copies of the test procedures and of the test results shall be provided to Owner per requirements established in Exhibit A-4 – Performance Testing Procedures (BESS).

1.6.5 **Project Execution Plan:** Prepare and submit for review a Project Execution Plan indicating a responsibility matrix; key Project contacts; document distributions; Project scope; Project organization; execution plan; administrative procedures; quality control procedures; Project schedule; equipment, piping, and instrument tagging procedures; design criteria; and other key Project execution functions.

1.6.6 **Quality Assurance and Quality Control:** Supplier and its Sub-Suppliers shall establish and maintain a documented QA Program conforming to applicable sections of this Specification.

1.6.6.1 Supplier shall furnish all factory acceptance test procedures and reports (on equipment with FATs) to Owner for review and approval.

1.6.6.2 At Owner's request, Supplier shall provide available manufacturers quality control documentation.

1.6.6.3 Owner shall pay Owner's costs associated with any Witness Test.

1.6.6.4 Installation, start-up and initial test instructions.

1.6.6.5 **Operating instructions**, including safety precautions. Normal operating modes, parameters and sequences (including startup and shutdown) shall be described together with normal running inspections for all supplied equipment and systems Special notes and cautionary statements shall be included and highlighted throughout the manual to enable easy recognition of special procedures and techniques that must be followed to ensure correctness and safety for equipment and personnel.

1.6.6.6 **Maintenance** Procedures and routine adjustments. Troubleshooting and diagnostic recommendations shall also be included. Maintenance and replacement instructions, which shall include detailed assembly drawings with parts numbers, parts lists, instructions for ordering spare parts, and complete preventative maintenance instructions required to ensure satisfactory performance and longevity of the equipment involved.

1.6.6.7 **Parts** illustrations, including parts lists adequate for the purpose of identifying and ordering replacement parts and lists of recommended spare parts for two (2) years of operation of any given component.

1.6.6.8 **Wiring schematics** for electrical equipment.

1.6.6.9 **Detailed descriptions of the functions** of each principal component of a system.

1.6.6.10 Performance and nameplate data.

1.6.6.11 **Safety precautions**.

1.6.6.12 Parts lists shall be submitted in standard excel format.

1.6.7 **Turn-Over Documents:** Supplier shall submit all Turn-Over documents for review and approval by Owner to fulfill requirements for Substantial Completion. These documents shall include all pre-commissioning and commissioning testing results and all of the above-mentioned documents and those mentioned in the Matrix at their respective milestone dates.

2 Approved Suppliers

2.1 General

2.1.1 This Section lists the acceptable supplies/vendors that the Supplier may utilize on the Project.

2.1.2 Owner will perform risk assessment on vendors per NERC CIP processes.

2.2 Acceptable Suppliers

2.2.1 Supplier shall provide equipment from the following vendors:

2.2.1.1 BESS

2.2.1.1.1 Canadian Solar

2.2.1.1.2 Tesla

2.2.1.1.3 LG

2.2.1.1.4 Sungrow

2.2.1.1.5 Fluence

2.2.1.1.6 Wartsila

2.2.1.1.7 Qcells

2.2.1.1.8 Trina

2.2.1.2 Inverter

2.2.1.2.1 Power Electronics

2.2.1.2.2 SMA

2.2.1.2.3 Sungrow

2.2.1.2.4 TMEIC

2.2.1.2.5 Chint Power Systems (CPS)

2.2.1.2.6 SolarEdge

2.2.1.2.7 Yasakawa

2.2.1.3 Medium Voltage Transformer

2.2.1.3.1 ABB (conditionally)

2.2.1.3.1.1 Supplier shall specify manufacturing location of ABB transformers and Supplier's involvement in quality assurance / quality control as respective facility.

2.2.1.3.1.2 Owner reserves right to accept or reject ABB as the medium voltage transformer manufacturer for the Project.

2.2.1.3.2 Eaton Corporation (Cooper Power Systems)

2.2.1.3.3 Eaglerise (conditionally)

2.2.1.3.4 JSHP (conditionally)

2.2.1.3.5 WEG

2.2.1.3.6 Westrafo

2.2.1.3.7 Howard

2.2.1.3.8 Emco

2.2.1.3.9 Owner realizes others may be used in combination with selected inverter, but those must be reviewed and approved by Owner and may have bearing on the inverter selection.

2.2.1.4 SCADA System

2.2.1.4.1 AlsoEnergy

2.2.1.4.2 Green Power Monitor (GPM)

2.2.1.4.3 NorCal Controls

2.2.1.4.4 Trimark

2.2.1.4.5 Vertech

2.2.1.4.6 Merit Controls

2.2.1.4.7 Terabase

3 Structural

3.1 Material

3.1.1 Steel

3.1.1.1 Design of hot-rolled structural and miscellaneous steel shall be in accordance with the American Institute of Steel Construction (AISC) "Manual of Steel Construction". Design of structural and miscellaneous steel shall also be in accordance with National Electrical Manufacturers Association (NEMA) "SG6" and "TT1", American Society of Civil Engineers (ACSE) "Guide for the Design of Steel Transmission Towers, Manual No. 52" and the International Code Council "International Building Code". Design of cold-formed steel shall be in

accordance with the American Iron and Steel Institute (ANSI) "North American Specifications for the Design of Cold-Formed Steel Structural Members".

3.1.1.2 Materials for structural steel and miscellaneous steel shall conform to the following requirements of the American Society for Testing and Materials:

3.1.1.2.1 Wide Flange (WF) Shapes and Tees cut from WF: ASTM A992, Grade 50 or multi-certification A36/A572, Grade 50.

3.1.1.2.2 M shapes, S shapes, HP (Bearing Piles), Channels, and Angles: ASTM A36

3.1.1.2.3 Structural Plates and Bars: ASTM A36

3.1.1.2.4 Square/Rectangular Hollow Structural Sections (HHS): ASTM A500 Grade B

3.1.1.2.5 Pipe: A53, Grade B

3.1.1.3 High strength bolts, nuts, and washers shall conform to ASTM A325, ASTM A563, and ASTM F436 respectively and shall be galvanized in accordance with ASTM A2329.

3.1.1.4 Bolts, nuts and washers under one-half inch in diameter shall conform to ASTM A307, Grade B, ASTM 563 and ASTM F844 respectively and shall be galvanized in accordance with ASTM F2329.

3.1.1.5 Anchor bolts, anchor bolt assemblies and concrete embedments shall be galvanized.

3.1.1.6 Anchor bolts shall conform to ASTM A449, ASTM F1554, Grade 36, or A307. Anchor bolt sleeves shall conform to ASTM A501.

3.1.1.7 All structural welding shall conform to the requirements of AWS D1.1.

3.1.1.8 Galvanizing, as specified herein, shall conform to the requirements of ASTM A123, ASTM A153 or ASTM A2329, as applicable.

3 Structural Loading

3.1 Supplier shall provide loading information according to the following information and in accordance with the locally adopted version of the IBC and ASCE 7 as modified by the applicable AHJ Local Additions and Addenda:

3.2 Dead Loads

3.2.1 Dead loads shall include all vertical loads due to weight of permanent structural and nonstructural components, including permanent hung loads.

3.3 Live Loads

3.3.1 Live loads shall be in accordance with the IBC and ASCE 7 as modified by the applicable agency Local Additions and Addenda.

3.4 Snow Loads

3.4.1 Snow design data shall be as provided in Exhibit B-1 – Project Specific Information.

3.5 Wind Loads

3.5.1 Wind design data shall be as provided in Exhibit B-1 – Project Specific Information.

3.6 Seismic Loads: Seismic load values from the final geotechnical report take precedence over those referenced below.

3.6.1 Seismic design data shall be as provided in Exhibit B-1 – Project Specific Information.

4 Corrosion Protection

4.1 In general, all exposed carbon steel surfaces shall be treated for corrosion protection. Supplier shall design and specify corrosion protection systems, for the following conditions:

4.1.1 Carbon steel exposed to ambient environmental conditions.

4.2 Stainless steel and galvanized steel shall not be painted.

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A-4

PERFORMANCE TESTING PROCEDURES (BESS)

EXHIBIT A-4
PERFORMANCE TESTING PROCEDURES (BESS)

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EXHIBIT A-4
PERFORMANCE TESTING PROCEDURES (BESS)

1.0 EXHIBIT INFORMATION

1.1 Project Description

1.1.1 See Exhibit B-1 – Project Specific Information

1.2 References

1.2.1 This Exhibit shall also be used in conjunction with other Exhibits, as applicable. The Specifications provided herein are intended to supplement other Exhibits but not necessarily duplicate; any Work exhibited in one and not in the other shall be executed as if it had been set forth in all.

1.3 Definitions

1.3.1 Unless defined in Exhibit A-3 (*Scope of Work (BESS)*), terms that begin with an upper case shall have the meaning defined in the Agreement.

1.3.2 See Exhibit A-3 (*Scope of Work (BESS)*) for respective meanings of terms used in this Exhibit.

2.0 PERFORMANCE TESTING

Supplier shall perform site Performance Testing to verify the supply of Equipment by the Supplier meets Performance Guarantees as defined in the Agreement. The nominal charge and discharge rate and power factor for this Project at the POI shall be as specified in Exhibit B-1 – Project Specific Information This exhibit supplements the testing set forth in Exhibit A-3 Attachment 2 - Technical Specification for all BESS installations.

2.1 Site Performance Tests

2.1.1 Nominal Capacity Test: In order to determine the average power and energy that can be discharged by the BESS (the "Project Capacity"), Supplier shall conduct a test in which the BESS is discharged at the nominal discharge rate setting for the BESS (the "Capacity Test"). The discharge duration shall exceed the minimum duration requirement at the nominal discharge rate specified. All values mentioned in Section 2.2.4 shall be recorded by the EMS during the entirety of the Capacity Test for use in the Charge Time Test. The MWh of energy discharged as measured by the BESS meter at the POI (net of auxiliary loads) (and the corresponding amount of power determined by dividing the foregoing by BESS duration in hours) shall be the "Capacity" of the BESS. The Capacity Test shall be performed to complete a total number of charge-discharge cycles as required by the Owner or as defined in the Agreement, with rest periods as recommended by the manufacturer or site design parameters and as agreed upon with Owner. The lowest Capacity of the BESS from any multiple test results shall be the final BESS Capacity result. The BESS Capacity shall be compared to the Capacity requirement as shown as the Power/Capacity Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine whether Liquidated Damages as specified in Section 3.2 of this Exhibit are owed for failing to achieve the required Performance Threshold. If the measured Capacity is greater than the Performance Threshold, the BESS Capacity shall be set equal to the Performance Threshold requirement. This test shall be performed yearly.

2.1.2 Charge Time Test and Charge Rate: In order to confirm the amount of time it takes the BESS to charge (the "Charge Time"), Supplier shall conduct a test to determine the actual amount of time in hours that the BESS requires to achieve the maximum State of Charge starting from minimum State of Charge (the "Charge Time Test"). The amount of time required during the Charge Time Test to achieve a maximum State of Charge shall be the BESS's Charge Time. The Charge Time requirement shall be satisfied if the Charge Time does not exceed the Charge Time Guarantee Performance Threshold as specified in Section 3.1 of this Exhibit. The Charge Time requirement shall be increased by 0.2 hours if the interconnection process determines that the load at the POI may not exceed the BESS Capacity by an amount of power equal to the Auxiliary Load's consumption. To confirm the charge rate for the BESS (the "Charge Rate"), Supplier shall calculate the average Charge Rate based on the amount of energy charged and the amount of time required to charge such energy from a minimum State of Charge to the maximum State of Charge as measured during the Charge Time Test. The Charge Rate shall be compared against the Charge Rate requirement as shown as the Charge Rate Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine if the BESS satisfies the Charge Rate requirement. If the Charge Time requirement increased by 0.2 hours as described above, the Charge Rate requirement shall be decreased proportionally.

2.1.3 Availability Test: In order to ensure that the BESS is fit for commercial operation, Supplier shall conduct a 120-hour continuous run test of the BESS to measure the availability of the BESS Capacity to operate in accordance with the technical capabilities of the BESS (the "Availability Test"). During the Availability Test, Owner shall have control over the BESS and shall select the set points for the BESS's operation in a manner consistent with the technical specifications for the BESS, the Charge Rate, and BESS Capacity determined under the Charge Time Test and Capacity Test. Supplier shall record the performance of the BESS during the Availability Test, including the MWh requested to be charged and discharged, the actual MWh discharged at the POI during the time period requested, and any outages or other failures that occur. The MW/MWh of the BESS affected by an outage or other failure during a Settlement Interval (as defined below) shall be deemed unavailable during the period that the outage or other failure exists. In addition, if the BESS fails to deliver the required energy or charge the required energy pursuant to any set point selected by Owner, the BESS shall be deemed to be partially unavailable during the period when the percentage difference in MW between the required output/input and actual output/input exceeds plus or minus 2%. Set points shall only be adjusted at the beginning/end of a Settlement Interval. The availability of the Project ("Project Availability") shall be determined in accordance with the following formula:

$$\text{Project Availability} = \left(\sum_{i=1}^{n} CA_i \right) / \text{n}$$

Where:
n = the total number of Settlement Intervals during the Availability Test
i = each Settlement Interval during the Availability Test
Settlement Interval = a 5-minute settlement interval
CA_i = with respect to Settlement Interval "i", 1 – (Unavailable Capacity/ Project Capacity)

Unavailable Capacity = with respect to Settlement Interval "i", the number of MW/MWh of the Project Capacity, minus the BESS Capacity (subject to the same being reduced to take into account the portion of the BESS Capacity that is unavailable to charge or discharge as a result of an outage or other failure), when the BESS Capacity is less than the Project Capacity.

BESS Project Availability shall be compared against the Availability Test requirement as shown as the Availability Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine whether Liquidated Damages as specified in Section 3.2 of this Exhibit are owed for failing to achieve the required Performance Threshold.

2.1.4 Nominal Round Trip Efficiency (RTE) Test: In order to determine the efficiency of the BESS to charge energy and return such energy through a discharge, the Supplier shall conduct a test starting at the minimum State of Charge and begin charging the BESS at the nominal charge rate until it achieves maximum State of Charge, and the BESS shall then discharge energy from the same State of Charge at the nominal discharge rate until it returns to minimum State of Charge (the "Nominal RTE Test"). The amount of energy charged and discharged during the Nominal RTE Test shall be measured by the BESS meter at the POI, unless otherwise stated. The Auxiliary Load consumed during the test, as measured by the Auxiliary Load meter, shall be included in the charging energy. The BESS's efficiency shall be determined by dividing the amount of energy discharged during the Nominal RTE Test by the amount of energy charged during the Nominal RTE Test (the "RTE"). The RTE Test may be performed in conjunction with the Capacity Test. The Nominal RTE Test shall be performed to complete a total number of charge-discharge cycles as required by the Owner or as defined in the Agreement, with rest periods as recommended by the manufacturer or site design parameters. The lowest RTE of the BESS from any multiple test results shall be the final BESS RTE result. The RTE shall be compared to the RTE requirement as shown as the RTE Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine whether Liquidated Damages as specified in Section 3.2 of this Exhibit are owed for failing to achieve the required Performance Threshold. This test shall be performed yearly.

2.1.5 Auxiliary Load Test: In order to determine the load consumed by the BESS, Supplier shall conduct a test to determine the amount of energy consumed by the BESS's auxiliary systems (the "Auxiliary Load Test"). The amount of energy consumed by the BESS's auxiliary systems (the "Auxiliary Load") shall be determined based on the power (kW) consumed during the entire duration of the testing at full charge rate and at full discharge rate. The measured Auxiliary Load shall be adjusted for ambient conditions based on correction curves provided by Supplier and shall be approved by Owner. The Auxiliary Load shall be measured and metered through a separate meter for the Auxiliary Loads provided by the Supplier. The Auxiliary Load shall be compared against the Auxiliary Load requirement as shown as the Auxiliary Load Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine if the minimum Performance Threshold has been achieved and for determining whether Liquidated Damages as specified in Section 3.2 of this Exhibit are owed for failing to achieve the required Performance Threshold.

2.1.6 Ramp Rate Test: In order to determine the ability of the BESS to ramp the BESS's power output between different set points, Supplier shall conduct a test to determine the response time of the BESS to changes between power output levels (the "Ramp Rate Test"). Owner shall select up to six (6) starting set points and an equal number of ending set points for the BESS that shall be used for purposes of the Ramp Rate Test. Test points shall be selected and communicated to Owner during development of the Test Plan. Supplier shall measure the time required to ramp power output between each starting and ending set point. The change in power output shall be divided by the period required to make such change in power output to determine the ramp rate for each change in set point and the average ramp rate per minute determined by averaging the results across all starting and ending set points shall be the BESS's ramp rate (the "Ramp Rate"). The Ramp Rate shall be compared against the Ramp Rate requirement as shown as the Ramp Rate Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine if the BESS satisfies the Ramp Rate requirement. Ramp Rate shall be based on the time from when the command is written to the EMS, according to Supplier-provided logging, until the system reaches set point according to metering at the POI. The system shall be considered to have reached the setpoint value as soon as the meter registers a steady value within 2% of the setpoint value.

2.1.7 Response Time Test: In order to determine the ability of the BESS to respond to commands from an off-line state, Supplier shall conduct a test to determine the response time of the BESS to go from an off-line state to the maximum discharge rate for the BESS and from an off-line state to the maximum charge rate for the BESS (the "Response Time Test"). The off-line state is defined by the AC breakers of the inverters being open and auxiliary power continues to be supplied to the system. The amount of time it takes the BESS to change from an off-line state to charging at the maximum charge rate and the amount of time it takes the BESS to change from an off-line state to discharging at the maximum discharge rate shall each be tested independently (each, a "Response Time"). The Response Time shall be compared against the Response Time requirement as shown as the Response Time Guarantee Performance Threshold in Section 3.1 of this Exhibit to determine if the BESS satisfies the Response Time requirement.

2.1.8 Standby Self-Discharge Rate Test: In order to determine the rate at which the BESS self-discharges its stored energy when synchronized to the grid, Supplier shall conduct a test to determine the lost energy from the BESS while the BESS is synchronized to the grid in standby mode, and all energy sources and parasitic loads except for auxiliary power, which shall continue to be provided from the grid (the "Standby Self-Discharge Rate Test"). The Self-Discharge Rate Test shall not be conducted until at least six hours after any charging or discharging of the BESS. The Standby Self-Discharge Test shall be conducted over a period of 48 hours starting with the BESS at a state of charge that is 5% below the maximum State of Charge. After 48 hours, the State of Charge shall be read by the EMS and the results of the Self-Discharge Rate Test shall be extrapolated to apply to a 30-day period (the "Standby Self-Discharge Rate") for purposes of determining whether the Standby Self-Discharge Rate requirement as shown as the Standby Self-Discharge Rate Guarantee Performance Threshold in Section 3.1 of this Exhibit has been satisfied. Supplier and Owner may mutually agree to test a subset of the BESS to reduce testing time.

2.1.9 Noise Ordinance Compliance Test: In order to determine that the BESS can operate in compliance with the applicable noise ordinance, an independent third-party shall, at Supplier's expense, conduct test(s) to determine the BESS's operating noise levels (the "Noise Ordinance Compliance Test"). The Noise Ordinance Compliance Test(s) shall be conducted at the system level and at Owner-specified operating modes. The BESS's operating noise levels shall not exceed the noise limit in the Agreement at the property line (the "Noise Ordinance Compliance Requirement") during any Noise Ordinance Compliance Test. The results of the Noise Ordinance Compliance Test(s) shall be used to determine whether the Noise Ordinance Compliance Requirement has been satisfied.

2.1.10 Subsystem Tests: In order to determine proper functioning of the BESS's subsystems, Supplier shall conduct isolated subsystem tests to determine if the BESS's HVAC, lighting, station/backup batteries perform as intended consistent with the manufacturer's specifications. Subsystem Tests shall be performed at the Project Site prior to tests tied to Performance Guarantees.

2.1.11 Other Owner Required Tests: The following tests shall be performed as outlined in Owner's offtake agreement:

- AGC Discharge Test
- AGC Charge Test
- Reactive Power Production Test
- Reactive Power Consumption Test

2.2 General Test Requirements

2.2.1 Test Plan: Supplier shall prepare and submit to Owner a proposed plan, including Performance Test Procedures, and schedule ninety (90) Calendar Days prior to performing the Performance Tests specified in Section 2.1 of this Exhibit ("Site Performance Tests"). The Supplier's Proposed Test Plan shall describe, with supporting detail, the actions, processes, protocols, and schedules for the performance and completion of the Performance Tests in accordance with this Exhibit and the requirements of the Agreement. Within ten (10) Business Days after Owner's receipt of Supplier's Proposed Test Plan, Owner shall notify Supplier that (i) the Proposed Test Plan is accepted, and is now considered final, or (ii) the Proposed Test Plan is not accepted. If Owner does not accept Supplier's Proposed Test Plan, then Owner and Supplier shall immediately commence work in good faith to develop a test plan that shall be acceptable to both parties. Failure by Owner to provide a response to Supplier's Proposed Test Plan shall not constitute acceptance of such Supplier's Proposed Test Plan. The final approved version of the Supplier's Proposed Test Plan shall be the "Final Test Plan." If any parameters set forth in the Final Test Plan vary from those set forth in this Exhibit, the time periods set forth in the Final Test Plan shall govern.

2.2.2 Test Date: Supplier shall give at least ten (10) Business Days of advance notice to commence any Performance Test. Owner shall have the right to be present (and have any Owner's representative present) during the performance of each Performance Test. Supplier shall give Owner and Owner's representative full and unrestricted access to observe the conductance of any Performance Test and unrestricted access to inspect the instrumentation necessary for Performance Test data acquisition prior to commencement of any Performance Test; provided that Owner and Owner's representative comply with the health and safety procedures applicable to such Performance Test.

2.2.3 Test Conditions:

- Prior to official commissioning and use of the site, a Cyber Risk Assessment of the site will be conducted by a 3rd party of the owner's choosing. Remediations will be implemented prior to being placed into service.

- At all times during the conductance of a Performance Test, the Project shall not be operated with abnormal operating conditions such as (i) unstable load conditions; (ii) operation outside of manufacturers' recommendations; (iii) operation outside of regulatory restrictions; or (iv) curtailment. If abnormal operating conditions occur during a Performance Test, Owner or Supplier may elect to postpone or reschedule all or a portion of such Performance Test in its reasonable discretion.

- Prior to testing, the EMS shall be successfully configured to receive data from the BMS, exchange DNP3 data with the SCADA device, transfer data to the database server for calculation, and record and archive data points. Communications protocols and communications connection requirements shall be modified, if necessary, to comply with NERC CIP standards.

- RTU testing shall be successfully completed prior to any Performance Testing. The interface between the RTU and SCADA system shall be fully tested and functional prior to starting any testing, including verification of the data transmission pathway between the RTU and EMS interface and the ability to record SCADA data. Communications protocols and communications connection requirements shall be modified, if necessary, to comply with NERC CIP standards.

- Prior to testing, commissioning shall be successfully completed per manufacturer guidance on all applicable installed Equipment, including verification that all controls, set points, and instruments of the EMS are configured.

- Owner has the right to request preliminary runs as part of any Performance Test prior to commencement of any test.

2.2.4 Data Recording: Supplier shall record all parameters at one (1) second intervals. Data includes, but is not limited to:

- Time.

- Total electrical energy discharged, measured at the POI (kWh).

- Total reactive energy discharged, measured at the POI (kVARh).

- Total electrical energy used to charge the BESS, measured at the POI (kWh).

- Total reactive energy used to charge the BESS, measured at the POI (kVARh).

- Total electrical energy discharged, measured at the PCS (kWh).

- Total reactive energy discharged, measured at the PCS (kVARh).

- Total electrical energy used to charge the BESS, measured at the PCS (kWh).

- Total reactive energy used to charge the BESS, measured at the PCS (kVARh).

-
- Station auxiliary power and energy, measured at BESS auxiliary meters (kW and kWh).
- Total electrical energy stored in the BESS (kWh).
- Total usable electrical energy stored in the BESS accounting for system losses (kWh).
- Ratio of usable electrical energy to total electrical energy stored in the BESS (%).
- BESS State of Charge (SOC).
- Battery temperatures (maximum, minimum, average, and standard deviation).
- Battery enclosure temperatures (maximum, minimum, average, and standard deviation).

2.2.5 Site Conditions Data Recording: Supplier shall record all conditions at the Project Site at thirty (30) second intervals. Data includes, but is not limited to:

- Relative humidity (%).
- Barometric pressure (inches Hg) near the horizontal centerline of the Project Site.
- Ambient air temperature (˚F).

2.2.6 Test Records: Supplier shall record the results of each Performance Test and provide all raw data, records and results associated with each Performance Test to Owner within four (4) Business Days following completion of such Performance Test. During the performance of each Performance Test, the Project shall be functioning in a manner to permit Owner to remotely monitor, observe, and independently verify the performance of the BESS through the Project's remote monitoring and control systems.

2.2.7 Incomplete Test: If any Performance Test is not completed in accordance with the Final Test Plan and this Exhibit, Owner may in its sole discretion: (i) accept the Performance Test results up to the time the Performance Test stopped; (ii) require that the portion of the Performance Test not completed, be completed within a reasonable specified time period; or (iii) require that the Performance Test be entirely repeated.

2.2.8 Final Report: Within ten (10) Business Days after the completion of a Performance Test (including a retest), Supplier shall prepare and submit to Owner a written report of the Performance Test. At a minimum, the report shall include:

- Description of the Final Test Plan applicable to such Performance Test.
- Record of the personnel present during all or any part of the Performance Test, whether serving in an operating, testing, monitoring or other such participatory role.
- Documentation confirming that the Performance Test was successfully run.
- Record of any unusual or abnormal conditions or events that occurred during the Performance Test and any actions taken in response thereto.

- Measured Performance Test data.

- Whether the Performance Test demonstrated that the Project achieved the applicable Performance Threshold for a Performance Guarantee, including supporting calculations, and if the Project did not achieve the Performance Threshold to such Performance Guarantee, the schedule for any rework and subsequent testing in order for Supplier to achieve the applicable Performance Guarantee.

- Supplier's statement of either Supplier's acceptance of the Performance Test or Supplier's rejection of the Performance Test results and reason(s) therefore. Within ten (10) Business Days after receipt of such report, Owner shall notify Supplier in writing of either Owner's acceptance of the Performance Test results or Owner's rejection of the Performance Test results and reason(s) therefore. Supplier shall re-perform any Performance Test if the Performance Test results were rejected by either party.

2.2.9 Instrumentation and Metering: The Project's installed metering equipment at the POI shall be used to record all energy discharged and charged by the Project, unless specifically stated to the contrary in this Exhibit. Supplier shall integrate all instrumentation and data collection equipment, by others, into their EMS as required to perform the Performance Tests. Instrumentation shall include all instruments permanently installed at the Project and the temporary instruments suggested by Supplier or deemed necessary by Owner in its sole judgement. Within thirty (30) Calendar Days of Owner's receipt of Supplier's Proposed Test Plan, Owner shall provide Supplier with written notice of the temporary calibrated instrumentation that shall be used during the Performance Tests. Wherever possible, the instrumentation, metering and data collection equipment that shall be used after the Project achieves Substantial Completion for monitoring and controlling the operation of the Project shall be used for the Performance Tests. Supplier shall calibrate or cause to be calibrated all such instrumentation, metering, and data collection equipment no more than three months prior to the date of the applicable Performance Test. Copies of all calibration sheets shall be provided to Owner at least five (5) Business Days prior to the commencement of the first Performance Test.

2.2.10 Costs and Energy Scheduling: Supplier shall be responsible for all costs incurred by it in conducting the Performance Tests. Owner shall be responsible for coordinating with the interconnecting utility the supply of all energy required for any Performance Test and shall receive the proceeds from the sale of any energy output during a Performance Test. Supplier shall provide all information necessary and requested by Owner to permit Owner to schedule the supply and delivery of energy from and onto the grid.

2.2.11 Retests: If Supplier fails to achieve the minimum Performance Threshold for any Performance Guarantee, Supplier shall make such necessary corrections and/or repairs to remedy the failure and shall re-perform the relevant Performance Test until the minimum Performance Threshold is achieved. If the Project does not achieve the Performance Threshold applicable to such Performance Test, Supplier shall pay the Liquidated Damages set forth in Section 3.2 of this Exhibit.

2.2.12 Excusable Event/Force Majeure Event: If an Excusable Event, Force Majeure Event, action or inaction of Owner or grid caused event that would adversely impact a Performance Test occurs during the performance of the Performance Test, the Performance Test shall be suspended for the duration of the Excusable Event, Force Majeure Event, action or inaction of Owner and shall be resumed after the Excusable Event, Force Majeure Event, or action or inaction of Owner is no longer adversely impacting the Performance Test.

3.0 PERFORMANCE GUARANTEES AND LIQUIDATED DAMAGES

3.1 Performance Guarantees

3.1.1 Supplier guarantees that the Project shall meet the Performance Guarantees and associated Performance Thresholds as listed in Exhibit B-1 – Project Specific Information

3.2 Liquidated Damages

3.2.1 If Supplier fails to achieve the Performance Threshold applicable to such Performance Guarantee, then Supplier shall pay Liquidated Damages for the applicable Performance Guarantee(s) as set forth in Exhibit B-1 – Project Specific Information until Supplier has re-tested and met the Performance Threshold for such Performance Guarantee.

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A-5

WARRANTY (BESS)

EXHIBIT A-5
WARRANTY (BESS)

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EXHIBIT A-5
WARRANTY (BESS)

1.0 EXHIBIT INFORMATION

1.1 Project Description

1.1.1 See Exhibit B-1 – Project Specific Information

1.2 References

1.2.1 This Exhibit shall also be used in conjunction with other Exhibits, as applicable. The Specifications provided herein are intended to supplement other Exhibits but not necessarily duplicate; any Work exhibited in one and not in the other shall be executed as if it had been set forth in all.

1.3 Definitions

1.3.1 Unless defined in Exhibit A-3 - Scope of Work (BESS), or in this Exhibit A-5, terms that begin with an upper case shall have the meaning defined in the Agreement.

1.3.2 See Exhibit A-3 - Scope of Work (BESS) for respective meanings of terms used in this Exhibit.

2.0 OVERVIEW

Supplier shall provide warranty coverage as set forth herein in conformance with the Requirements (the "Warranty") as well as a Performance Guarantee. The Warranty and Performance Guarantee shall include the following main features:

1. Warranty: Supplier shall provide a warranty on the BESS and the Work provided or undertaken under the Scope of Work for a period of not less than five (5) years from the date of Substantial Completion.
    a. The Warranty shall protect against defects in the BESS, and the Equipment to the extent not otherwise incorporated in the BESS, and workmanship.
    b. The Warranty shall be comprehensive. No deductibles shall be allowed for travel time, service hours, repair parts cost, etc.
2.
3. Third-Party Warranties: Supplier shall obtain warranty coverage on the Equipment as set forth below in conformance with the OEM specifications and the Requirements ("Third-Party Warranties").
    a. If an extended warranty on any component of the BESS is required to meet the Requirements, Bidder shall provide optional cost of warranty extension.
4. Performance Guarantee: Supplier shall provide the Performance Guarantee for a period of not less than twenty (20) years.

For the purpose of this Exhibit, each of Owner and Supplier shall be a "Party" hereunder, and together shall be the "Parties".

3.0 GENERAL WARRANTY INFORMATION

3.1 Warranted Items

3.1.1 Supplier grants the Warranty to Owner with respect to:

- The BESS;
- Each article of Equipment and auxiliary and ancillary equipment provided by Supplier under the Agreement to the extent not otherwise included in the Equipment, in each case, delivered either for the inventory of Owner or for installation at the Project pursuant to the Supplier's Scope of Work (collectively, the "Products"); and,
- The Work and/or Services provided under the Agreement, (together the "Warranted Items").

Supplier shall prepare a register of equipment (the "Register"), cataloging the type and quantity of Products and the respective date of the Third-Party Warranty start date with respect to each such equipment. Supplier shall deliver the Register (or updated Register, as applicable) to Owner, within thirty (30) Calendar Days prior to initial product delivery to Project Site.

3.2 Warranty

3.2.1 Supplier warrants to Owner that:

- The BESS shall (i) be free from defects, (ii) conform to the Specifications as described in Exhibit A-3 - Scope of Work (BESS) and (iii) be suitable for Owner's use.
- All Products supplied pursuant to the terms of this Exhibit shall (i) be free from defects, (ii) conform to the Specifications as described in Exhibit A-3 - Scope of Work (BESS) and (iii) be suitable for Owner's use in the Project.
- Services and Work shall be performed in accordance with the Specifications described in Exhibit A-3 - Scope of Work (BESS) and in conformance with the Requirements.
- None of the Work rendered by or through Supplier hereunder, nor any license granted hereunder, infringes, violates or constitutes a misappropriation of any Intellectual Property Rights.

3.3 Correction of Defects

3.3.1 If any Warranted Items are defective, Supplier shall (a) notify Owner of such defect and (b) cure such defect as promptly as practicable, including all required installation and any oversizing or battery capacity augmentation (inclusive of hardware costs) to the extent necessary ("Warranty Service"). Owner shall provide Supplier with reasonable access to the Project in order to perform its obligations, and the Parties shall schedule such Warranty Service so as to minimize disruptions to the operation of the Project. Supplier shall bear all costs and expenses associated with the Warranty Services, including all costs of labor and equipment and of any necessary disassembly, removal, replacement, transportation, reassembly, reinstallation, and retesting, as well as reworking, repair or replacement of such Work, and reassembly of structures, electrical work, machinery, Equipment, or any other obstruction as necessary to give access to the non-conforming item for correction, and for removal, repair or replacement of any damage to other work or property that arises from the breach of Warranty. Upon completion of Warranty Service, all Equipment shall be returned or restored to its proper condition (subject to normal wear and tear), including fit alignment, adjustment, operability, and finish. If Supplier is obligated to repair, replace, or renew any Equipment, item or portion of the Work hereunder, Supplier shall undertake a technical analysis of the problem and correct the "root cause" unless Supplier can demonstrate to Owner's reasonable satisfaction that there is no material risk of the reoccurrence of such problem.

3.4 Third Party Warranties

3.4.1 Supplier shall keep in force, and shall be responsible for enforcing, the Third-Party Warranties). Supplier shall ensure that Third-Party Warranties include provisions for assignments to Owner and Owner "step-in" rights in the event of Supplier default and/or termination of the LTSA during the term of the Third-Party Warranties. Third-Party Warranties shall include serial defects protections.

3.5 Performance Guarantees

3.5.1 Supplier hereby covenants that from and after the Substantial Completion date, the Project shall satisfy the Performance Guarantee. In the event that the Project does not satisfy the Performance Guarantee, as Owner's sole and exclusive remedy for any such failure, the Supplier shall pay the applicable Performance Guarantee Liquidated Damages as provided in Section 3.0 of Exhibit A-4 (*Performance Testing Procedures (BESS)*).

3.6 Performance Guarantee Rights and Remedies

3.6.1 Within thirty (30) Calendar Days after the end of the applicable reporting period, Owner shall send an invoice to Supplier, if, as determined pursuant to Exhibit A-4 (*Performance Testing Procedures (BESS)*), any Performance Guarantee Liquidated Damages are due to be paid with respect to such reporting period. The Performance Guarantee Liquidated Damages shall be due and payable on the date thirty (30) Calendar Days after the applicable Party's receipt of the relevant invoice.

3.7 No Implied Warranties

3.7.1 The Warranties set forth in this Exhibit are exclusive and in lieu of all other warranties, express or implied, written or oral, including any warranty of merchantability or fitness for a particular purpose. There are no other warranties, agreements, oral or written, or understandings which extend beyond those set forth in this agreement with respect to the Warranted Items,. The foregoing sentence is not intended to disclaim any other obligations of Supplier set forth herein.

ATTACHMENT D
BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT A-6
BASELINE SCHEDULE

EXHIBIT A-6 – BASELINE SCHEDULE (PLACEHOLDER PROVIDED BY RESPONDENT)

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT B

PROJECT SPECIFIC INFORMATION AND PRELIMINARY DESIGN

EXHIBIT B-1 – PROJECT SPECIFIC INFORMATION

DRAFT EXHIBIT B-1
PROJECT SPECIFIC INFORMATION

1.0 - PROJECT DESCRIPTION

Contractor is to provide Engineer, Procurement and Construction of XXX MW/XXXX MWh Battery Energy Storage System (BESS), Project Substation and Gen-Tie. Main Power Transformer (MPT), HV breakers, BESS enclsoure, and PCS skid will be procured delivered to the site by the Bidder.

2.0 - PROJECT DATA

Project Name
XXXX BESS
Owner
Minnesota Power
Project Size & Duration
XXX MW, X Hour
Project Location
TBD
POI
TBD
Project Substation
Voltage: XXX kV
Location: Project Site
Gen-Tie Line
Voltage: XXX kV
Project Operational Life
XX years
Equipment Design Life
Batteries: XX years
PCS: XX years

3.0 - GENERAL SITE CONDITIONS

Site Elevation
XXX Feet
Weather Station
TBD
Expected Annual Maximum Temperature per ASHRAE
TBD
Expected Annual Minimum Temperature per ASHRAE
TBD
20 Year Return Period Values of Extreme Temperature per ASHRAE
XX Maximum (DB), XX Maximum (WB)
XX Minimum (DB), XX Minimum (WB)
Rainfall (25yr-24hr)
XXX

4.0 - STRUCTURAL DESIGN CRITERIA

DRAFT EXHIBIT B-1
PROJECT SPECIFIC INFORMATION

Risk Category
XXX
Snow
Importance Factor, I_s = XXX
Ground Snow Load, p_g = XXX psf
Wind
Basic Wind Speed, V = XXX mph (ult) / XXX mph (asd)
Exposure Category XXX (Surface Roughness XXX)
Topographic Factor, K_{zt} = XXX
Minimum Wind Pressure (Components & Cladding) = 16 psf
Seismic
Importance Factor, I_e = XXX
Short period (0.2-sec) site coefficient, F_a = XXX
Long period (1.0-sec) site coefficient, F_v = XXX (Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8)
Mapped short period (0.2-sec) spectral response acceleration (5% damped), S_s = XXXg
Design short period (0.2-sec) spectral response acceleration (5% damped), S_{DS} = XXXg
Mapped 1.0 sec period spectral response acceleration (5% damped), S_1 = XXXg
Design 1.0 sec period spectral response acceleration (5% damped), S_{D1} =XXX (Ground motion hazard analysis may be required. See ASCE/SEI 7-16 Section 11.4.8)
Seismic Design Category: XXX (See ASCE/SEI 7-16 Section 11.6)
Site Class: XXX
Peak Ground Acceleration (site-modified), PGA_M = XXXg
Component Importance Factor, I_p = XXX (unless approved by Owner)
Corrosion Protection
Minimum ISO corrosivity category: XXX
Corrosion protection design life to match equipment design life
5.0 - BESS
Description
BESS shall be rated for XXX MW for a continuous X-hour duration measured at the POI to provide energy storage services including discharging energy, installed capacity and effective capacity, ancillary services, and capacity attritubes to meet requirements of Owner's executed off-take agreement for the facility. This measurement should be net of any Auxiliary Loads for cooling, UPS, and control, unless otherwise specified in the performance acceptance test. The POI requirements must be met for the entirety of the Project Life starting at Substantial Completion.
BESS Power Output
XXX MWAC
BESS Energy Capacity
XXX MWh
Base Annual Throughput
XXX,XXX MWh (XXX Cycles)
Maximum Annual Throughput

DRAFT EXHIBIT B-1 PROJECT SPECIFIC INFORMATION
XXX,XXX MWh (XXX Cycles)
Maximum Cycles Per Day
TBD
RTE (AC)
XX%
Power Factor at POI
X.XX
Overbuild/Augmentation
TBD
Battery Information
Manufacturer: TBD
Model: TBD
PCS Information
Manufacturer: TBD
Model: TBD
MV Transformer Output Voltage: XX.X kV
MV Transformer Rated Power: TBD
EMS Services
Power Plant Controller
Closed Loop Control
Frequency Response
Voltage Response
Real Power Control
Reactive Power Control
Voltage Ride Through
Spinning Reserve
Non-Spinning Reserve

ATTACHMENT D
BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT C
SUBMITTALS

EXHIBIT C-1 – CONTRACTOR DELIVERABLES

EXHIBIT C-2 – SUBMITTAL SCHEDULE

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT C-1

CONTRACTOR DELIVERABLES

EXHIBIT C-1
CONTRACTOR DELIVERABLES

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EXHIBIT C-1
CONTRACTOR DELIVERABLES

1.0 EXHIBIT INFORMATION

1.1 Project Description

1.1.1 See Section 1.0 of Exhibit B-1 (*Project Specific Information*).

1.2 References

1.2.1 This Exhibit shall also be used in conjunction with other Exhibits, as applicable. The Specifications provided herein are intended to supplement other Exhibits but not necessarily duplicate; any Work exhibited in one and not in the other shall be executed as if it had been set forth in all.

1.3 Definitions

1.3.1 Unless defined in Exhibit A-1 (*Scope of Work (BESS BOP)*), terms that begin with an upper case shall have the meaning defined in the Agreement.

1.3.2 See Exhibit A-1 (*Scope of Work (BESS BOP)*) for respective meanings of terms used in this Exhibit, unless otherwise defined in this Exhibit.

1.3.3 For the purposes of only this Exhibit, the following terms shall have the respective meanings as set forth below:

(1) Shop Drawings, Product Data, and Samples are "**Technical Submittals**" prepared by Contractor, Subcontractor, supplier, or manufacturer and submitted by Contractor to Owner as a basis for approval of the use of Equipment and Materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance, or technical properties, as specified in Exhibit A-1 (*Scope of Work (BESS BOP)*).

(a) "**Shop Drawings**" shall include custom prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.

(b) "**Product Data**" shall include standard printed information on materials, products, and systems; not custom prepared for this Project, other than the designation of selections from available choices.

(c) "**Samples**" shall include both fabricated and unfabricated physical examples of Materials, products, and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection or where indicated for more detailed testing and analysis. Mockups are a special form of samples which are too large to be handled in the specified manner for transmittal of sample submittals.

(2) Technical Reports, Administrative Submittals, Certificates and Guarantees not defined as Shop Drawings, Product Data, or Samples are "**Informational Submittals**", submitted by Contractor to Owner for information and do not require Owner approval prior to proceeding with the Work.

(a) "**Technical Reports**" shall include laboratory reports, tests, technical procedures, technical records, and Contractor's design analysis.

(b) "**Administrative Submittals**" shall mean the nontechnical submittals required by the Agreement or deemed necessary for administrative records. These submittals include maintenance agreements, bonds, Project photographs, physical work records, statements of applicability, copies of industry standards, Project record data, schedules, security/protection/safety data, and similar type submittals.

(c) "**Certificates**" and "**Guarantees**" are submittals on Equipment and Materials where a written certificate or guarantee from the manufacturer or Contractor is provided, as specified in Exhibit A-1 (*Scope of Work (BESS BOP)*).

1.4 Purpose

1.4.1 This Exhibit defines the Contractor deliverables to be submitted for the Project Site with the following information:

(1) Schedule for the deliverables to be submitted to Owner.

(2) Review/approval requirements.

(3) Format that the deliverables are to be submitted to Owner.

2.0 GENERAL REQUIREMENTS

2.1 Responsibilities

2.1.1 Contractor is responsible for submitting documentation in accordance with Exhibit C-2 (*Submittal Schedule*).

2.1.2 Upon receipt of any submittal, Contractor shall allow ten (10) Business Days for Owner review and comment cycle for all documents and drawings unless otherwise indicated.

2.1.3 Owner reserves the right to review all engineering documents and records produced by Contractor at the 60% and 90% design review meetings and until Project Substantial Completion.

2.1.4 Contractor shall provide As-Built Drawings for all drawings used and issued for construction according to the Project Schedule.

2.2 Instructions

2.2.1 Contractor shall review and comment on Supplier technical documentation. Contractor shall develop detailed design taking into consideration information and data included in the Supplier documentation.

2.2.2 Owner reserves the right to comment on any document submitted regardless of submittal purpose. Definitions of the codes Contractor shall include with each document submitted shall be as follows:

(1) Issued for Owner Review (IFR): Contractor shall submit documents to Owner for review and approval.

(2) Issued for Information (IFI): Contractor shall submit documents to Owner for information only.

(3) Issued for Construction (IFC): Contractor shall submit documents to Owner for review.

2.2.3 Owner shall, by a notice to Contractor, issue comments or indicate the acceptance or rejection of submittals per the agreed upon Submittal Schedule. Owner review of and/or comments, or lack of comments, to Contractor documents does not relieve Contractor of any contractual requirements.

2.2.4 All submittals and shop drawings require review and approval from Engineer of Record. After approved by Engineer of Record, Contractor shall send to Owner for approval.

2.2.5 Contractor shall name and label all submittals using an Owner-approved naming convention. Such naming convention shall be used consistently for all submittals, and the only filename modification for revised submittals shall be a change in revision number. Unidentifiable submittals shall be returned for proper identification.

2.2.6 Final Project design submittals shall be accompanied by copies of native, electronic design files (e.g., AutoCAD .dwg file, .KMZ, .SHP, PLS-CADD .bak file, electrical model files (PSS/E, EasyPower, ETAP, CYME), etc.).

2.2.7 All design submittals shall be provided in a common and consistent coordinate system. Such coordinate system shall be subject to Owner approval.

2.3 Quality Requirements

2.3.1 Submittals such as drawings and data submitted to Owner shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings shall be useable for further reproduction to yield legible hard copy.

2.3.2 Documents submitted to Owner that do not conform to specified Requirements shall be subject to rejection by Owner, and upon request, Contractor shall resubmit conforming documents. If conforming submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's or its Subcontractor's failure to initially satisfy the legibility quality requirements shall not relieve Contractor or its Subcontractors from meeting the required schedule for submittals.

2.3.3 Owner approval of Contractor deliverables shall not alleviate the Contractor’s responsibility for compliance with Requirements detailed in this Agreement.

2.4 Language and Dimensions

2.4.1 All words shall be in the English language.

2.4.2 All dimensions shall be in United States Customary units.

2.4.3 Metric dimensional unit equivalents may be stated in addition to United States Customary units.

2.5 Submittal Completeness

2.5.1 Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Owner to review the information effectively.

2.5.2 Where standard drawings are furnished which cover a number of variations of the general class of Equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the Equipment being furnished.

2.6 Form of Submittals

2.6.1 Submittals and other Project documents shall be transmitted in electronic format using an Owner approved document management system.

(1) Selected submittals may be provided in paper ("hardcopy") copies with advance approval of Owner.

2.6.2 Scanned submittals and documents are not acceptable. Transmit submittals and Project documents in the following format:

(1) Word-searchable .pdf files created directly from native electronic format, or Owner-approved equal.

(2) Electronic submittals in .tif format are permitted only with specific Owner approval.

(3) Electronic submittal .pdf files are not to be combined files or collections of files/drawings. Each drawing or document shall stand alone.

(4) Each file shall be left to right reading, oriented portrait or landscape, and shall be the same orientation and same size for all consecutive resubmissions.

2.6.3 Each drawing shall be submitted with an electronic filename that is equivalent to the drawing or document number without revision, and any resubmitted drawing or document shall use the same filename as the original file name each time.

2.6.4 Contractor submittals shall be accompanied with a completed transmittal letter. Submittals that are not accompanied with an approved transmittal letter may not be accepted and may be returned to Contractor.

2.6.5 Equipment instruction books and operating manuals shall be in .pdf format combined in one .pdf file for the complete operations and maintenance (O&M) manual or divided into .pdf files that represent entire volumes (corresponding to hardcopy volumes). The .pdf files shall be completely bookmarked with links within the index sheet to the different sections within the manuals/volumes, corresponding to the defined tabs within the hardcopy version.

2.6.6 All Contractor transmittal letters submitted to Owner shall be in the form supplied and shall contain as a minimum the following information:

(1) Contractor’s Name.

(2) Owner’s contract number.

(3) Filename.

(4) Description of the information contained in the specific submittal.

(5) Revision number.

(6) Submittal type.

(7) Date of submittal.

2.6.7 Nonconforming submittals are subject to rejection by Owner.

2.6.8 Provide "as-constructed" submittals, record documents, Equipment instruction books and operating manuals, and other documents on USB or external hard drive in native AutoCAD format or as required and approved by Owner.

2.6.9 Owner's review comments shall be provided electronically.

2.6.10 Prepare and submit the following lists for review:

(1) Equipment List.

(2) Instrument List.

(3) Terminal Point/Connection List.

(4) I/O List.

2.6.11 Above lists shall be in Microsoft Excel format and Contractor shall not modify the format or sequence without approval. Lists shall be submitted for initial review and resubmitted as a final list.

3.0 TECHNICAL SUBMITTALS

3.1 Schedule of Submittals

3.1.1 Prepare for Owner's concurrence a schedule of submittals for submission of all submittals specified or necessary for Owner's approval of the use of Equipment and Materials proposed for incorporation in the Work or needed for proper installation, operation, or maintenance. Submit the schedule with the Project Schedule. Schedule submission of all submittals to allow review, fabrication, and delivery in time to not cause delay in the Work of Contractor or its Subcontractors or any other contractors as described herein.

3.1.2 In establishing the schedule of submittals, allow fourteen (14) Days in Owner's possession for reviewing original Submittals and twenty-one (21) Days for reviewing resubmittals, where possible.

(1) Submittals may be expedited to support construction schedule. Submittals requiring expedited review shall be brought to Owner's attention prior to submittal. In no event shall Owner be required to support a submittal review duration less than seven (7) Days.

3.1.3 Submittals requiring revisions shall be resubmitted within twenty-one (21) Days after receipt of Owner's review comments.

3.1.4 The schedule shall indicate anticipated dates of original submission for each item and Owner's approval thereof and shall be based upon at least one resubmission of each item.

3.1.5 Schedule all submittals (Shop Drawings, Product Data, and Samples) that are required prior to fabrication for submission as necessary to meet contract delivery requirements. Contractor shall allow Owner time to review these submittals.

3.1.6 Resubmit submittals the number of times required for Owner's approval. However, any need for resubmittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining approval of submittals, shall not be grounds for extension of the contract time provided Owner completes reviews within the times specified.

3.1.7 Where a submittal is required by the Specifications or the accepted schedule of submittals, Contractor shall not commence production of any part of the Equipment and Materials affected thereby until such submittal has been reviewed and approved by Owner.

3.1.8 Contractor shall meet submittal requirements in the Deliverables Matrix in Section 5.0 of this Exhibit.

3.2 Transmittal of Submittals

3.2.1 All submittals (Shop Drawings, Product Data, and Samples) for Equipment and Materials furnished by Contractor, Subcontractors, manufacturers, and suppliers shall be submitted to Owner by Contractor.

3.2.2 Transmit all submittals to Owner for approval as follows:

(1) Mark each submittal by Project name and number, contract title and number, and applicable Specification section and article numbers. Include in the letter of transmittal the drawing number and title, sheet number (if applicable), revision number, and electronic file name (if applicable). Unidentifiable submittals shall be returned for proper identification.

(2) Check and approve submittals of Subcontractors, suppliers, and manufacturers prior to transmitting them to Owner. Contractor's submission shall constitute a representation to Owner that Contractor approves submittals and has determined and verified all design criteria, quantities, dimensions, materials, catalog numbers, compliance with Laws and Regulations, and similar data, and Contractor assumes full responsibility for doing so; and Contractor has coordinated each submittal with requirements of the Work and the Contract Documents.

(3) At the time of each submission, call to the attention of Owner, via substitution request or Request for Information (RFI), any deviations from requirements of the Contract Documents.

(4) Make all modifications noted or indicated by Owner and return the required number of revised submittals until approved by Owner. Direct specific attention on revised submittals to all changes from previous submittals using clouds or other approved markings. After electronic copy submittals have been approved, submit copies thereof for final distribution. Previously approved submittals transmitted for final distribution shall not be further reviewed and are not to be revised. If errors are discovered during manufacturing or fabrication, Contractor shall correct the submittal and resubmit for review.

(5) Following completion of the Work and prior to final payment, furnish record documents and approved Samples and Shop Drawings necessary to indicate "as constructed" conditions, including field modifications. Furnish additional copies for insertion in Equipment instruction books and operating manuals as required. All such copies shall be clearly marked "Project RECORD."

(a) Submit a final record copy of the master field drawing list which shall indicate the final revision status of each drawing on the list.

(b) Accompany submittal with transmittal letter containing date, contract number and title, Contractor's name, address and telephone number, number and title of each record document and signature of Contractor's authorized representative.

3.3 Owner Review

3.3.1 Owner shall review and take appropriate action on submittals in accordance with the accepted schedule of submittals. Owner's review and approval shall be only to determine if items of Equipment covered by the submittals are compatible with the design concept and conform to information given in the Contract Documents.

3.3.2 Such review and approval shall not extend to design data reflected in submittals which is peculiarly within the special expertise of Contractor or Contractor's Subcontractors or suppliers. Review and approval of a component item as such shall not indicate approval of the assembly in which the item functions.

3.3.3 Owner's review and approval of Shop Drawings, Product Data, or Samples shall not relieve Contractor of responsibility for any deviation from requirements of the Contract Documents unless Contractor has in writing called Owner's attention to such deviation at the time of submission, and Owner has given written concurrence in and approval of the specific deviation. Approval by Owner shall not relieve Contractor from responsibility for errors or omissions in submittals.

3.4 Submittal Action Stamp

3.4.1 A review action stamp, appropriately completed, shall appear on all Contractor submittals when returned by Owner. Review status designations are to indicate whether Approved, Approved as Noted, Revise and Resubmit, Not Approved, For Reference Only, etc.

3.5 Instruction Books and Operating Manuals

3.5.1 Equipment instruction books and operating manuals prepared by the manufacturer shall include the following:

(1) Index and tabs.

(2) Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers.

(3) Applicable drawings.

(4) Warranties and guarantees.

(5) Name and address of nearest manufacturer-authorized service facility.

(6) All additional data specified.

3.6 Samples (if required)

3.6.1 Office samples shall be of sufficient size and quantity to clearly illustrate the following:

(1) Functional characteristics of the product, with integrally related parts and attachment devices.

(2) Full range of color, texture, and pattern.

(3) Material, manufacturer, pertinent catalog number, and intended use.

4.0 INFORMATIONAL SUBMITTALS

4.1 Schedule of Submittals

4.1.1 Include all Information Submittals in a schedule of submittals for Owner's review.

4.2 Transmittal of Submittals

4.2.1 All Informational Submittals furnished by Contractor, Subcontractors, manufacturers, and suppliers shall be submitted to Owner by Contractor unless otherwise specified.

(1) Identify each submittal by Project name and number, contract title and number, and applicable Specification section and article numbers. Include in the letter of transmittal the drawing number and title, sheet number (if applicable), revision number, and electronic file name (if applicable). Unidentifiable submittals shall be returned for proper identification.

(2) At the time of each submission, call to the attention of Owner in the letter of transmittal any deviations from the requirements of the Contract Documents.

5.0 DELIVERABLES MATRIX

5.1 General Information

5.1.1 See Exhibit C-2 (*Submittal Schedule*).

5.2 Submittal Descriptions

5.2.1 See Exhibit A-1 (*Scope of Work (BESS BOP)*) for additional descriptions.

5.2.2 Equipment Outline Drawings

(1) Outline dimensional drawing.

(2) Location of all interface connections (plan and elevation).

(3) Recommended/required mounting details clearly depicting bolting and/or anchor location, size, material, and projection requirements, or sufficient data such that the installing Contractor can establish such requirements.

(4) Weight and center of gravity.

(5) Type of interface connection (e.g., bolted, welded, weld end preparation, flange/base metal thickness or schedule, etc.).

(6) Removal space/maintenance requirements.

(7) Special rigging requirements.

5.2.3 Equipment Installation Details

(1) Drawings showing how to install all devices that require field installation.

(2) Details including support/mounting devices.

(3) Field welding requirements.

(4) Field erection requirements; assembly drawings.

5.2.4 Foundation Loadings and Details

(1) Foundation details/outlines depicting overall dimensions, pad and blockout requirements, anchor bolt locations and details, and any additional information necessary to establish the foundation arrangement.

(2) Actual foundation design loads, and their points of application, including all component loads (i.e., dead, live, wind, seismic, thermal, pressure, dynamic, etc.) and a tabulation of all the combinations of each component load for each load case.

5.2.5 Structural and Miscellaneous Steel

(1) Certified shop drawings and erection diagrams for all structural steel, miscellaneous steel, and ductwork.

(2) Documents prepared in accordance with the AISC specification for the design, fabrication, and erection of structural steel for buildings.

(3) Connection details.

(4) Platforms and stairs.

5.2.6 System I/O list

(1) Tabulation of all inputs and outputs associated with a PLC or SCADA to be used to control the supplied system.

(2) Provide tag name, description, signal type, signal level, signal power, on state description, off state description, range, engineering units, alarm setpoints, alarm dead-bands, etc.

(3) Identify recommended sequence of events points.

(4) Communication Link I/O lists.

5.2.7 Control Logic Diagrams

(1) Shall be formatted in function block format and all logic function symbols properly interconnected to indicate the logic.

(2) All input and output points shall be properly identified identical to the I/O list.

(3) The tag number and description of each field device shall be included on the logic diagrams.

(4) All analog logic shall be in MCAA (SAMA) format, and all digital logic shall be in Boolean or ISA style.

(5) System description narrative.

(6) Alarm list & priorities.

5.2.8 Control Logic Narrative

(1) A control logic narrative shall be included with a description for each logic diagram that includes the system operation (control and monitoring), permissives and interlocks, and alarms.

5.2.9 Operator Interface Screen or Panel Layouts

(1) Detailed physical diagrams of all supplied control panels (internal and external).

(2) All lights and switches including color.

(3) All tagging/labeling.

(4) For graphics, sketches of recommended graphic screens with I/O tags identified.

5.2.10 Instrument Data Sheets

(1) ISA type data sheets with information including process data, manufacturer, base model, number, and tag number.

5.2.11 Instrument List

(1) Tabulation of all instrumentation.

(2) Provide tag name, description, ID number, device “Low” and “High” range information for analog signals, engineering units, setpoints for switches, installation detail number, manufacturer’s, model number, data sheet number, calibration sheet number, schematic number, location plan number.

5.2.12 Instrument Installation Details

(1) Instrument installation details.

(2) Identify the bill of materials required for the installation.

(3) Instrument rack construction details.

5.2.13 Calibration Sheets

(1) Individual sheet for each supplied instrument.

(2) Sign off sheet verifying field calibration of the device.

5.2.14 Instrument Location Plans

(1) Physical drawing showing the location of all instrumentation, instrument racks, and instrument tap locations including the associated elevations.

5.2.15 Electrical One-Line Diagram

(1) Representation of the complete electrical system showing major components and their interconnections.

5.2.16 Electrical Three-Line Diagram

(1) Representation of the complete electrical system showing individual phase conductors of the three-phase power system.

5.2.17 Electrical Load List

(1) Tabulation of all loads (load in kW and kVA).

(2) Tabulation for each load shall include rated voltage, continuous and noncontinuous amperage, full-load, and operating amperage, quantity of in-service vs. spare, number of phases, and indication of power source type (e.g., breaker, fuse, etc.).

(3) Display tag number and description for all Equipment.

5.2.18 Electrical Equipment Layout

(1) Physical diagrams, including dimensions and component layout, of all electrical Equipment (internal and external).

(2) All operator interfaces, such as disconnects, push buttons, switches, etc. (including colors).

(3) All nameplates and labels.

(4) Enclosure type and material.

(5) Physical drawing showing the location of each of the electrical interface points and elevation of equipment in respect to the Site elevation.

(6) Location of each device that requires interconnection with others.

(7) Available conduit entry areas and threaded conduit entry sizes, as applicable.

(8) Callouts for all electrical Equipment and Materials to indicate component description, ratings, manufacturer, and supplier model numbers (if different).

(9) Display tag number and description for all Equipment.

5.2.19 Electrical Schematic

(1) Detailed schematics showing each light, switch, controller, relay, terminal block number, etc., associated with a systems control circuit.

(2) Equipment wiring diagrams showing all wire, cable, and terminations.

(3) AC one-line and three-line diagrams showing all power distribution and Equipment ratings.

(4) All voltage and current ratings.

(5) Special wiring requirements (coax, high temperature, etc.).

(6) All electrical connections to be provided by others explicitly identified.

(7) Continuous and noncontinuous amperage and required feeder breaker ratings for each power connection by others.

(8) Display tag number and description for all Equipment.

(9) Interconnection Wiring Diagrams

(10) Overall system diagram showing 100% of the field wiring required.

(11) Interface of each device or panel being supplied in the system.

(12) Voltage and current ratings.

(13) Conductor size range limitations for all field terminations.

(14) Special grounding requirements.

(15) All cable numbers shall be included.

(16) The color code for each conductor of each cable shall be indicated with clear termination information for both ends of every cable or circuit.

(17) Display tag number and description for all Equipment

5.2.20 Electrical Cable List

(1) Tabulation of all field-installed cables required between Equipment furnished with this Contract.

(2) Provide cable number, from device tag, from device description, to device tag, to device description, schematic number, cable supplied by, type of cable required, size of cable required, etc.

(3) Display tag number and description for all Equipment.

5.2.21 Electrical Conduit List

(1) Tabulation of all field-installed conduits required between Equipment furnished with the Agreement.

(2) Provide conduit number, from device tag, from device description, to device tag, to device description, raceway plan drawing number, material supplied by, material type, trade size, etc.

(3) Display tag number and description for all Equipment.

5.2.22 Factory Acceptance Test Plan

(1) List and describe all procedures for factory testing of the control Equipment prior to testing.

5.2.23 O&M Manuals

(1) Index and tabs.

(2) Description of Equipment.

(3) Performance correction curves.

(4) Operation instructions shall include precautions and critical points to be observed during equipment operation. Detailed procedures providing step-by-step instructions for start-up and shutdown of Equipment for both normal and emergency conditions shall be included.

(5) Training presentation files in native format.

(6) Troubleshooting.

(7) Equipment drawings.

(8) Equipment, line, and instrument lists.

5.2.24 BESS Electrical Studies as described in Section 5.2 of Exhibit A-1 (*Scope of Work (BESS BOP)*).

5.2.25 Fire Protection Plans as described in Section 5.5 of Exhibit A-1 (*Scope of Work (BESS BOP)*).

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT C-2

SUBMITTAL SCHEDULE

Instructions and Definitions
All submittals shall be delivered in electronic format
All days are listed as Calendar Days

EXHIBIT C-2
SUBMITTAL SCHEDULE

Category	Item #	Title of Submittal	With Proposal	NTP	30%	60%	90%	Issued for Construction	Mobilization	Mechanical Completion	Substantial Completion	Other
General	G1	Preliminary Work Progress Schedule	x									
General	G2	Detailed Baseline Schedule (plus monthly updates)		x								
General	G3	Initial Weekly Construction Progress Report (plus weekly updates)							x			
General	G4	Initial Contractor Document List (plus monthly updates)		14 Days after								
General	G5	Safety Data Sheets (if required)										28 Days prior to bringing material onsite
General	G6	Field Staffing Plan							28 Days prior			
General	G7	Two-Year O&M Spare Parts List (vendor, part number, quantity, cost)				x						
General	G8	Start Up and Commissioning Spare Parts Lists				x						
General	G9	Preliminary O&M Manual				x						
General	G10	Final O&M Manual						x				
General	G11	Health, Safety, Security, Environmental (HSSE) Plan							28 Days prior			
General	G12	Lifting and Rigging Plan							28 Days prior			
General	G13	Quality Assurance Plan		28 Days prior								
General	G14	Factory Acceptance Testing (FAT) Procedures										14 Days prior to test
General	G15	Factory Acceptance Testing (FAT) Reports										14 Days after test
General	G16	Emergency Response Plan (ERP) (construction)							56 Days prior			
General	G17	Preliminary Project Execution Plan	x									
General	G18	Detailed Project Execution Plan							28 Days prior			
General	G19	Signage Plan (construction and operation)							56 Days prior			
General	G20	Training Agenda							28 Days after			
General	G21	Training Classes								Start minimum of 42 Days prior		
General	G22	Mechanical Completion Checklist and Testing Plan (for review and for construction)								60 Days prior		
General	G23	Substantial Completion Checklist and Testing Plan (for review and for construction)									60 Days prior	
General	G24	Shipping Plan										45 Days prior to shipment
General	G25	Packing List										2-3 Days prior to shipment
General	G27	Country of origin for all Equipment				x						
General	G28	Preliminary Permit Matrix	x									
General	G29	Permitting Plan and Permits (construction and operation)		28 Days after								
Civil	C1	Site Layout			x	x	x	x				
Civil	C2	Site Control Points				x	x	x				
Civil	C3	Erosion Control Plan, Sections, and Details				x	x	x				
Civil	C4	Stormwater Collection & Detention Plan				x	x	x				
Civil	C5	Stormwater Calculations				x	x	x				
Civil	C6	Stormwater Collection & Detention Sections and Details				x	x	x				
Civil	C8	Cut/Fill Quantities				x	x	x				
Civil	C9	Site Grading Plan				x	x	x				
Civil	C10	Site Finishing Plan					x	x				
Civil	C11	Pavement Sections & Details					x	x				
Civil	C12	Site Access Plan			x	x	x	x				
Civil	C13	Fencing Plan, Sections, and Details				x	x	x				
Civil	C14	Project Site Roadways Testing Schedule							x			
Civil	C15	Civil Quality Assurance Reports						x				14 Days after test
Civil	C16	Landscaping Plan (if required)				x	x	x				
Civil	C17	Seeding Plan				x	x	x				
Civil	C18	Planting Schedule				x	x	x				
Civil	C19	Stormwater Pollution Prevention Plan (SWPPP) (if required)					x	x				
Structural	S1	Structural Site Design Criteria			x	x	x	x				
Structural	S2	Statement of Special Inspections				x	x	x				
Structural	S3	Structural Site Plan				x	x	x				
Structural	S4	Foundation General Notes & Standard Details				x	x	x				
Structural	S5	Foundation Enlarged Area Plan(s) and Details				x	x	x				
Structural	S6	Foundation Sections & Details				x	x	x				
Structural	S7	Equipment Anchorage Details					x	x				
Structural	S8	Structural Steel Plans and Elevations				x	x	x				
Structural	S9	Structural Steel Sections & Details					x	x				
Structural	S10	Structural Calculations						x				
Structural	S11	Structural Quality Assurance Reports						x				14 Days after test
Electrical	E1	Electrical Site Plan		x	x	x	x	x				
Electrical	E2	BESS Area		x	x	x	x	x				
Electrical	E3	Substation Area		x	x	x	x	x				
Electrical	E4	Substation Structure Elevations		x	x	x	x	x				
Electrical	E5	Electrical Single Line Diagram(s)		x	x	x	x	x				
Electrical	E6	Electrical Three-line Diagram(s)				x	x	x				
Electrical	E7	Panel Schedule(s)					x	x				
Electrical	E8	Metering and Relaying One-Line Diagram(s)				x	x	x				
Electrical	E9	Conduit Schedule				x	x	x				
Electrical	E10	Cable Schedule				x	x	x				
Electrical	E11	Grounding Plans & Details				x	x	x				
Electrical	E12	Below Grade Raceway/Conduit Plan(s)				x	x	x				
Electrical	E13	Duct Bank Sections				x	x	x				

Instructions and Definitions
All submittals shall be delivered in electronic format
All days are listed as Calendar Days

EXHIBIT C-2
SUBMITTAL SCHEDULE

Category	Item #	Title of Submittal	With Proposal	NTP	30%	60%	90%	Issued for Construction	Mobilization	Mechanical Completion	Substantial Completion	Other
Electrical	E14	Duct Bank and Manhole Details				x	x	x				
Electrical	E15	Trench Plans, Sections, & Details				x	x	x				
Electrical	E16	Embedded Conduit Stub-Ups				x	x	x				
Electrical	E17	Above Grade Raceway/Conduit Plan(s)				x	x	x				
Electrical	E18	Above Grade Conduit/Raceway Elevations				x	x	x				
Electrical	E19	Above Grade Conduit Isometrics				x	x	x				
Electrical	E20	Conduit/Raceway Standard Details				x	x	x				
Electrical	E21	AC Schematics				x	x	x				
Electrical	E22	DC Schematics				x	x	x				
Electrical	E23	Site Controls System Architecture				x	x	x				
Electrical	E24	Network Control Rack Elevation(s) and BOM					x	x				
Electrical	E25	Network Configuration Settings						x				
Electrical	E26	Network Mapping						x				
Electrical	E27	Control Enclosure Plan				x	x	x				
Electrical	E28	Fiber Optic Wiring Diagram(s)					x	x				
Electrical	E29	Ethernet Wiring Diagram(s)					x	x				
Electrical	E30	Site Lighting Plan				x	x	x				
Electrical	E31	Site Lighting Details					x	x				
Electrical	E32	Energization Plans and Procedures for the Collection System Circuit										28 Days prior to energization
Electrical	E33	Auxiliary Equipment Shop Drawings						x				
Electrical	E34	Auxiliary Equipment Product Data Sheets						x				
Electrical	E35	Auxiliary Transformer Manufacturer's Factory Test Certificate								x		
Electrical	E36	Communications Product Data Sheets						x				
Electrical	E37	Electrical Studies				x	x	x				
Electrical	E38	Load Flow/Reactive Power Study				x	x	x				
Electrical	E39	Cable Thermal (Sizing) Study				x	x	x				
Electrical	E40	Short Circuit Study (AC and DC)				x	x	x				
Electrical	E41	Arc Flash Study					x	x				
Electrical	E42	Grounding				x	x	x				
Electrical	E43	Lightning Protection					x	x				
Electrical	E44	Voltage Drop Study				x	x	x				
Electrical	E45	Concentric Induced Voltage Report					x	x				
Electrical	E46	Harmonics				x	x	x				
Electrical	E47	Insulation Coordination				x	x	x				
Electrical	E48	Transient Overvoltage				x	x	x				
Electrical	E49	Power System Stability				x	x	x				
Electrical	E50	Power Quality				x	x	x				
Electrical	E51	Electromagnetic Compatibility				x	x	x				
Electrical	E52	Relay Settings						x				
Electrical	E53	Controls Narrative					x	x				
Project Substation	SS1	Civil/Structural Design & Drawings										
Project Substation	SS2	General Arrangement			x	x	x	x				
Project Substation	SS3	Site Plan Include KMZ			x	x	x	x				
Project Substation	SS4	CAD File			x	x	x	x				
Project Substation	SS5	Elevation Views			x	x	x	x				
Project Substation	SS6	Major Bill of Materials			x	x	x	x				
Project Substation	SS7	Foundation Design and Drawings				x	x	x				
Project Substation	SS8	Grading and Drainage			x	x	x	x				
Project Substation	SS9	Structural Steel Design				x	x	x				
Project Substation	SS10	Steel Fabrication Drawings				x	x	x				
Project Substation	SS11	Fencing and Signage Design and Drawings				x	x	x				
Project Substation	SS12	Civil/Structural Studies										
Project Substation	SS13	Steel Design Calculations				x	x	x				
Project Substation	SS14	Foundation Design Calculations				x	x	x				
Project Substation	SS15	Bus Calculations				x	x	x				
Project Substation	SS16	Electrical Design & Drawings										
Project Substation	SS17	Switching Single-line			x	x	x	x				
Project Substation	SS18	Relaying Single-line			x	x	x	x				
Project Substation	SS19	Control Building Layout			x	x	x	x				
Project Substation	SS20	Relay Panel Elevations			x	x	x	x				
Project Substation	SS21	Control Building Bill of Materials			x	x	x	x				
Project Substation	SS22	Major Bill of Materials			x	x	x	x				
Project Substation	SS23	Major Equipment Shop Drawings				x	x	x				
Project Substation	SS24	DC Schematics				x	x	x				
Project Substation	SS25	Three-lines & Schematics				x	x	x				
Project Substation	SS26	Grounding Plan and Details				x	x	x				
Project Substation	SS27	Conduit Plan and Details				x	x	x				
Project Substation	SS28	Conduit and Cable Schedule				x	x	x				
Project Substation	SS29	Station Service Details				x	x	x				

Instructions and Definitions
All submittals shall be delivered in electronic format
All days are listed as Calendar Days

EXHIBIT C-2
SUBMITTAL SCHEDULE

Category	Item #	Title of Submittal	With Proposal	NTP	30%	60%	90%	Issued for Construction	Mobilization	Mechanical Completion	Substantial Completion	Other
Project Substation	SS30	Lighting Plan and Details				x	x	x				
Project Substation	SS31	Lightning Protection Plan				x	x	x				
Project Substation	SS32	Control Building Wiring Diagrams					x	x				
Project Substation	SS33	Yard Equipment Wiring Diagrams					x	x				
Project Substation	SS34	Electrical Studies										
Project Substation	SS35	Geotechnical Report Review			x	x						
Project Substation	SS36	Reactive Power (if not provided with Collection System)										
Project Substation	SS37	Bus Ampacity			x	x	x	x				
Project Substation	SS38	Substation Grounding				x	x	x				
Project Substation	SS39	DC Service (Battery and Charger) Sizing				x	x	x				
Project Substation	SS40	Station Service Sizing			x	x	x	x				
Project Substation	SS41	Insulation Coordination				x	x	x				
Project Substation	SS42	Substation Lightning Protection				x	x	x				
Project Substation	SS43	Lighting/Illumination				x	x	x				
Project Substation	SS44	Substation IEEE Effectively Grounded					x	x				
Project Substation	SS45	Protective System Coordination					x	x				
Project Substation	SS46	Pre-Energization Harmonics					x	x				
Project Substation	SS47	Post-Energization Harmonics										
Project Substation	SS48	Substation Arc Flash Hazard Assessment					x	x				
Project Substation	SS49	Temporary Over-Voltage (Including Collection System)				x	x	x				
Project Substation	SS50	Electrical Device Settings										
Project Substation	SS51	Protective Relay Settings Report					x	x				
Project Substation	SS52	PRC-005 Relay Testing Template										Record
Project Substation	SS53	Check Metering Settings						x				
Project Substation	SS54	LTC Control Settings						x				
Project Substation	SS55	Data Concentrator Settings						x				
Project Substation	SS56	HMI Programming						x				
Project Substation	SS57	Civil/Structural/Electrical Specifications										
Project Substation	SS58	Substation Design Basis			x							
Project Substation	SS59	Major Equipment Specs			x	x	x	x				
Project Substation	SS60	Control Building Spec			x	x	x	x				
Project Substation	SS61	Construction Spec				x	x	x				
Project Substation	SS62	Review of Technical Specifications			x	x	x	x				
Gen-tie	GT1	Design & Drawings										
Gen-tie	GT2	Typical Structure Design (with range of heights)			x							
Gen-tie	GT3	Overall Line Routing Include KMZ			x	x	x	x	x			
Gen-tie	GT4	PLS-CADD File			x	x	x	x	x			
Gen-tie	GT5	Structure Assembly Drawings				x	x	x	x			
Gen-tie	GT6	Plan and Profile Drawings			x	x	x	x	x			
Gen-tie	GT7	Structure Locations and Pole Sizes			x	x	x	x	x			
Gen-tie	GT8	Major Bill of Materials			x	x	x	x	x			
Gen-tie	GT9	Full Bill of Materials				x	x	x	x			
Gen-tie	GT10	Fiber/OPGW Details				x	x	x	x			
Gen-tie	GT11	Structure Loading Tree Drawings				x	x	x	x			
Gen-tie	GT12	Foundation Drawings				x	x	x	x			
Gen-tie	GT13	Stringing Charts				x	x	x	x			
Gen-tie	GT14	Structure Grounding				x	x	x	x			
Gen-tie	GT15	Vibration mitigation					x	x	x			
Gen-tie	GT16	Phasing Diagrams					x	x	x			
Gen-tie	GT17	Specifications										
Gen-tie	GT18	Transmission Line Design Basis			x	x	x	x				
Gen-tie	GT19	Material Specifications				x	x	x				
Gen-tie	GT20	Construction Specs				x	x	x				
Gen-tie	GT21	Review of Technical Specifications			x	x	x	x				
Gen-tie	GT22	Studies & Calculations										
Gen-tie	GT23	Geotechnical Report Review			x	x						
Gen-tie	GT24	Conductor sizing/Operating Voltage			x							
Gen-tie	GT25	ROW width/Blowout			x							
Gen-tie	GT26	Structure Staking Report			x	x	x	x				
Gen-tie	GT27	Line Crossing Calculations			x	x	x	x				
Gen-tie	GT28	Clearance Calculations			x	x	x	x				
Gen-tie	GT29	Line Impedance and Susceptance			x	x	x	x				
Gen-tie	GT30	Gradient/Corona Calculations			x	x	x	x				
Gen-tie	GT31	EMF Calculations / Induced Voltage Study (if required)				x	x	x				
Gen-tie	GT32	Shielding and Lightning Performance Report				x	x	x				
Gen-tie	GT33	Continuous/Emergency Rating Calculations				x	x	x				
Gen-tie	GT34	Short Circuit Rating				x	x	x				
Gen-tie	GT35	Guy Anchor Calculations (if required)				x	x					
Gen-tie	GT36	Structure Calculations				x	x					

Instructions and Definitions
All submittals shall be delivered in electronic format
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EXHIBIT C-2
SUBMITTAL SCHEDULE

Category	Item #	Title of Submittal	With Proposal	NTP	30%	60%	90%	Issued for Construction	Mobilization	Mechanical Completion	Substantial Completion	Other
Gen-tie	GT37	Drilled Pier Foundation/Embedment Calcs				x	x					
Gen-tie	GT38	Galloping Conductor Analysis				x	x					
Gen-tie	GT39	Vibration Calculations					x					
Fire/Safety	F1	Fire Protection Design Basis Document			x							
Fire/Safety	F2	Fire Protection Conceptual Plan Drawings			x							
Fire/Safety	F3	Fire Protection Construction Documents					x	x				
Fire/Safety	F4	Fire Protection Shop Drawings, Cutsheets, and Calculations				x	x	x				
Fire/Safety	F5	Fire Alarm Equipment and Component Cutsheets				x	x	x				
Fire/Safety	F6	Fire Alarm Riser Diagrams				x	x	x				
Fire/Safety	F7	Fire Alarm System Wiring Diagrams					x	x				
Fire/Safety	F8	Fire Alarm Voltage Drop and Battery Calculations					x	x				
Fire/Safety	F9	Fire Alarm System Sequence of Operations Matrix					x	x				
Fire/Safety	F10	Fire Water Equipment and Material Cutsheets				x	x	x				
Fire/Safety	F11	Fire Water Piping Plans				x	x	x				
Fire/Safety	F12	Fire Water Hydraulic Calculations				x	x	x				
Fire/Safety	F13	Fire Alarm Operations and Maintenance Manual with Inspection, Testing, and Maintenance Plan						x		x		
Fire/Safety	F14	Hazard Mitigation Analysis (HMA)					x	x				
Fire/Safety	F15	Emergency Response Plan (ERP)					x	x				
Fire/Safety	F16	Failure Mode & Effect Analysis (FMEA) (if required by NRTL for UL 9540 Certification)					x	x				
Fire/Safety	F17	Fire Protection Commissioning Plan							x			
Fire/Safety	F18	UL 9540 Certification Plan and Schedule (if required)				x	x	x				
Fire/Safety	F19	UL 9540 Certification (if required)									x	
Fire/Safety	F20	Fire Alarm System Acceptance Test Reports and "Record of Completion" Documentation per NFPA 72								x		
Fire/Safety	F21	Fire Water System "Contractor's Material and Test Certificate for Underground Piping" per NFPA 24								x		
Reports	R1	Geotechnical Investigation Report				x	x	x				
Specifications	Y1	Equipment Procurement Technical Specifications				x	x	x				
Specifications	Y2	Construction Specifications					x	x				

ATTACHMENT D
BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT D
OWNER STANDARDS

EXHIBIT D-1 – ENGINEERING SERVICES DRAWING PROCESS & STANDARDS

EXHIBIT D-2 - REQUIRED FILE DELIVERABLES

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT D-1

ENGINEERING SERVICES DRAWING PROCESS & STANDARDS

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Engineering Services Drawing Process & Standards

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Engineering Services Drawing Process & Standards

1) Purpose

a) To ensure all drafters/designers understand and know how the drawing process works.
b) This document is used for internal reference, training new employees and external groups. This procedure may be shared with other organizations to support communication and establish process expectation.
c) This will allow for efficient drawing creation and approval, as well as ease of document management after the project has been completed.

2) Scope

a) This document provides a general overview of the drawing process.

3) Terms and Abbreviations

a) Support Engineering Services-Drafting & Documentation
b) ImageSite – eQuorum software used to store and secure engineering documentation.
c) AutoCAD – Software application utilized by drafters/engineers.
d) Bluebeam- Software utilized by drafters/engineers for marking up prints.
e) SharePoint – online document depository used for Vendor collaborations.
f) Tiff – image of a signed drawing for drawing records/attached to hybrid DWG.
g) PDF - Electronic document/images/record of signed drawing
h) CTS - Cyber Technology Services
i) PE – Professional Engineer Stamp
j) MP – Minnesota Power
k) S&T – Substation and Transmission
l) (reserved)

4) Reference Documents

a) ImageSite User Guide
b) Alpha List (three letter location code)
c) Drawing Number Database
d) Drawing Templates
e) Drawing Borders & Revision Block
f) CDS 205.01 – Substation Drawing Issuing Procedure
g) ES-DM1001 – Internal Drawing Request and Doc Search Request
h) ES-DM1002 – External Drawing Request
i) Construction Issue Control Drawings Fillable
j) Construction Issue Physical Drawings Fillable
k) Work Tracking Log
l) Documentation Task Tracker
m) (reserved)

5) Application

a) For Minnesota Power drawings and/or documents being revised, we will provide all necessary prototype drawings, fonts, symbols and standard details to be used for drawing creation. It is required that these standards be used exclusively and that no additional items be added. If additional symbols or font characters are deemed necessary for the project, they should be submitted to Minnesota Power Engineering Services who will add them to the Minnesota Power fonts or symbol list and resubmit the standards. Due to the open architecture of AutoCAD, consistency through a well-defined set of CAD standards including layering, colors, and text styles is essential. To maintain consistency throughout the drawing process, the requirements of these standards must be adhered to.

b) For Vendor drawings and/or documents – Required AutoCAD drawings. The drawings that follow the vendor standard, they need to keep the vendor drawing number and cannot duplicate MP Drawings or numbers.

6) Responsibilities

a) It is the responsibility of the Minnesota Power Engineering Services, Drafting & Engineering Documentation group to establish and maintain these standards and issue all copies and revisions to the appropriate parties. All questions and comments should be addressed to:

b) Engineering Services Drafters: engineeringsupportservices@mnpower.com
   a) Taunya Ripley (TRipley@mnpower.com)
   b) Christine Sloth, (CSloth@mnpower.com)
   c) Kayla Billadeau, (tmp_kbilladeau@mnpower.com)
   d) Melissa LaMar (mlamar@mnpower.com)
   e) Michael Cattel, (mcattel@mnpower.com)
   f) Noah Burggraff, (nburggraff@mnpower.com)
   g) Will Yoki, (wyoki@mnpower.com)

c) Engineering Services Document Management:
   a) engsvcsdocmgmt@mnpower.com

   b) Kari Fitzsimmons (KFitzsimmons@mnpower.com)
   c) Mia Menendez (mmenendez@mnpower.com)

7) CAD Environment

a) The required software for generating drawings for Minnesota Power is Autodesk products: AutoCAD, Civil 3D, Raster, Mapping, REVIT, etc. Exceptions will not be accepted without prior approval from Engineering Services, Drafting & Engineering Documentation.

   a) **File Format:** The final product file format will be the AutoCAD's .dwg, rvt. Exceptions will be considered for specific reasons with prior approval from Minnesota Power's Engineering Services, Drafting & Engineering Documentation and will only accept exceptions after careful examination and review.

   b) **3rd PARTY APPLICATIONS**: Third party applications to AutoCAD may be used if the final product does not lose any data or information when opened with AutoCAD's software.

   c) **NON-AUTOCAD APPLICATIONS**: Drawings generated with other CAD systems and converted to AutoCAD format via translators will not be accepted without prior approval from Engineering Services, Drafting & Engineering Documentation.

8) File Transfer:

a) File transfer will be received via SharePoint/Teams or vendor's associated network (Power360, etc.) that allows sharing of files both ways between MP and Vendor. Regardless of method of delivery, each shipment of drawing files must include an electronic copy of "Letter of Transmittal or Drawing Tracker"' In addition to the letter of transmittal or drawing tracker, all drawing shipments will include a complete updated drawing list, showing drawing title, drawing number, issue date, and current revision number.
b) Minnesota Power Project Number – As specified in project manual
c) Transmittal Number – Sequential-numbering system determined at project startup.
d) Transmittal Issue Date – Date transmittal was sent.
e) Drawing Size – Actual paper size to issue.
f) Minnesota Power Drawing Number – Provided by Minnesota Power, if requested.
g) Consultant Drawing Number – Provided by Vendor
h) Drawing Title – Title of drawing in title block.
i) Revision Number – Sequential numbering.
j) Revision Date – Date revision was completed.
k) Drawn by – person that drafted the drawing. If there are two drafters, they will both put their initials.
l) Approval – The peer reviewer or PE Engineer
m) Revision 0, Construction needs to be a PE Engineer.
n) As built/Construction revision can have an initial of the approver.
    a) Approver –
        (1) The individual overseeing the project or responsible for implementing the changes.
        (2) The person accountable for the project or who executed the modifications.
        (3) The designated project lead or the one who made the adjustments.
        (4) The authority on the project or the originator of the changes.
    b) Scale – No Scale or scale according to the drawing
    c) Drawing Status/Revision Description –
        (1) "Return – No Change"
        (2) "Return – Not Used"
        (3) "Reference Only – Issue with Set"
        (4) "Released For Construction"
        (5) "For Information Only"
        (6) "For Approval Only"
        (7) "For Bidding Only"

o) Requesting reference only drawings will be stripped of border and will have a splash that states it is Reference Only. More details below in the “Reference Files” section.

p) If the requested drawing has no updates, it needs to be returned stating there were no changes.

9) File Backups and Archiving:

a) All drawings and engineering data will be backed up and archived, for the current revisions in addition to the previous revisions of the drawing in ImageSite. Companies that provide engineering and design/drafting services for Minnesota Power will backup and archive the files for a period of no less than three years after project completion. All engineering design/drafting data remains the exclusive property of Minnesota Power with no limitation as to its future use. The final electronic version of all drawing files shall be submitted to Minnesota Power.

10) File Naming Structure:

a) Minnesota Power drawing borders incorporate specific attribute data that allows the document management system to process drawings efficiently. It is therefore very important that consultants or other companies that provide Minnesota Power with digital drawing data do not alter the drawing borders or the file-naming format. The following is a brief description of drawing identification attributes. Drawing numbers should be assigned as needed from the Engineering Services Department

(1) **Internal working area:**
   (a) \\p\projects for 'Internal Users' to work on their checked-out AutoCAD files.
   (b) Under Drafting file structure in Chester 2
   (c) Start with the location alpha code folder
   (d) Followed by the folder that designated the drafter’s MP username
   (e) Next the project name
   (f) Add the drawing files
   (g) The typical structure will look like this: \\p\projects\cadd\private\chester\chester2\ within the 'chester2' area, there will be multiple 3-letter alpha directories that represent each of Minnesota Power's physical sites that have related engineering drawings. Under these 'alpha directories', internal users are to create a directory with their own username and build any necessary sub-directories. Example: use 'CCB' as a typical alpha directory. \cadd\private\chester\chester2\CCB\csloth\. In this case, the directory

'csloth' will hold any additional directories or files that user csloth deems necessary for working purposes. It is the responsibility of the individual users to keep their personal directories cleaned up once projects are complete. Original files are moved to 'ImageSite uploads' for uploading into ImageSite, and other miscellaneous files should be moved to archive folders or deleted.

(2) **File Naming Convention:**

(a) Some file names will have 'dashes' and 'sheet' numbers, with this information separated by a single underscore '_' character. Dash values will always have two numeric characters if they are used (see below for dash identifications). In this case, 'ME-' is the established border size (see Border sizes below), 12345 is the five character drawing number, '03' is the two character dash value, '2' is the sheet value, and '.dwg' is the file extension. Only the designated 'original' electronic files shall follow this file naming convention.

(b) If there is no dash value in the file name, there will be two consecutive underscore characters before the sheet number. Example: ME-12345__2.dwg.

(c) Do not have multiple copies of a drawing/version. If a drawing has multiple versions for uploads, they should be in upload 1st, upload 2nd.

(d) A naming exception is when dealing with civil 3D base files for example ME-12345_00_BASE, always download & only modified with permission from primary engineer who it's checked out for (file kept in engineering sub archive for use) and upload a copy to ImageSite as archival/backup.

(e) Vendor drawings shall include project number in the electronic file naming. If there is no drawing number then the project number will be used as the drawing number, for example: 110582_A3.00. In this example 11058 is the project number and A3.00 is the sheet number.

11) **Dash Identifications –**

Physical - ME-PHYSTD_00_01 (Standard's drawing)

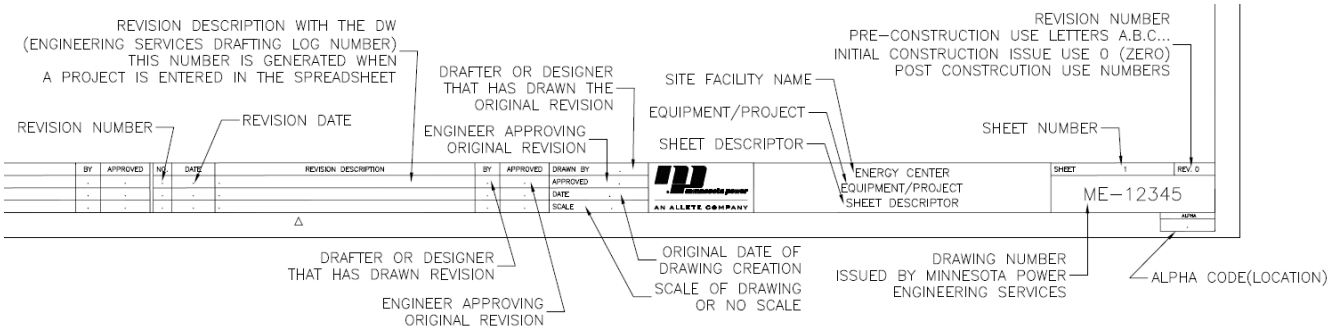
a) -00 Index (for substation prints)
b) -01 Land Ownership & Easements
c) -02 Topography or Drainage or Grading or Access Road Plans or Soil Borings
d) -03 Public Plan or Construction Plan or Erosion Control Plan or Landscape Plan
e) -04 General Site Arrangement
f) -05 Foundation & Fence Plan
g) -06 Foundation Details
h) -07 Grounding Plan
i) -08 Conduit & Raceway Plan or Conduit & Raceway Details
j) -09 Precast Cable Trench & Details
k) -10 Lighting & Yard Power Plan or Lighting and Yard Power Details
l) -11 Spare (Open) Cable Bus Plan and Details
m) -12 SPCC or Oil Containment Plan

n) -13 Structural Steel Plan
o) -14 Structural Steel Details
p) -15 Air Break Switch Arrangement
q) -16 Phasing Diagram or One Line or Three Line
r) -17 Electrical Plan & Elevations
s) -18 Electrical Apparatus Details
t) -19 Fire Protection
u) -20 Shielding Plan
v) -21 Sound Level Contours
w) -22 Control House Plan
x) -23 Control House Lighting, HVAC Plan & Details
y) -24 Other Structures or Communication Buildings or Warehouse or Storage
z) -25 Power Connectors

12) Control - ME- 35702_00_1 (Standard's drawing)OR MB+***

a) -00 Index/M&R Diagram/Tripping/Block Close (for substation prints)
b) -01 AC & DC Station Service Panels
c) -02 Alarm System
d) -03 Potential & Synchronizing
e) -04 Bus Differential
f) -05 Control House Layout – EEE Plan & Details
g) -06 Digital Fault Recorder (DFR)
h) -07 Cable & Conduit List
i) -08 thru -25 Relay/Control Panels
j) -26 thru -30 Communication Panels
k) (Comm Panels start on -30 and go in reverse)
l) -31 Remote Terminal Unit (RTU)/SCADA
m) -32 Synchronizing Panel
n) -33 Termination Cabinet
o) -34 Metering Panel
p) -35 Second Remote Terminal Unit (RTU)/SCADA Panel
q) -36 thru ∞ as needed

13) Title Block Components:



14) Reference Files:

a) The use of reference files in generating drawings for Minnesota Power is permitted only with prior approval from the Engineering Services Department. Upon approval, the following requirements apply:
b) All entities associated with the reference file must be permanently bound to the final drawing file.
c) Any file created for use as a reference must include a visible “Reference Only” designation in the drawing.
d) When receiving a Reference Only print from Minnesota Power the border information will be removed

15) Borders and Paper Sizes:

a) Any drawing using a Minnesota Power number will utilize drawing borders and title blocks provided by Minnesota Power in the form of template drawings (dwt). The title blocks will have specific attributes that will be required to be completed prior to being accepted by Minnesota Power (see section 12). The attributes will correspond with the requirements of the Minnesota Power document management system. Layouts already designed by Minnesota Power are integrated into the Minnesota Power templates and utilize the following paper dimensions. The Minnesota Power drawing templates already have predetermined dim styles and text styles, which make their use advantageous to everyone.

    a) Template dwt locations are: \\P\projects\CADD\private\Chester\Cad Standards\Templates
    b) Border dwg locations are: \\P\projects\CADD\private\Chester\Cad Standards\Borders and Revision Blocks\Borders
    c) Revision block locations are: \\P\projects\CADD\private\Chester\Cad Standards\Borders and Revision Blocks\Revision Blocks
    d) Minnesota Power will provide these templates if required.

b) Substation Schematic & Wiring Diagrams: As of January 2002 substation schematic & wiring diagrams are being converted to ME-size (see dimensions below) at the discretion of the project engineer, document management and drafting department. Check with the supervisor or project engineer for specific instructions. ME-size should be used when starting a new drawing series.

Drawing Border Sizes:

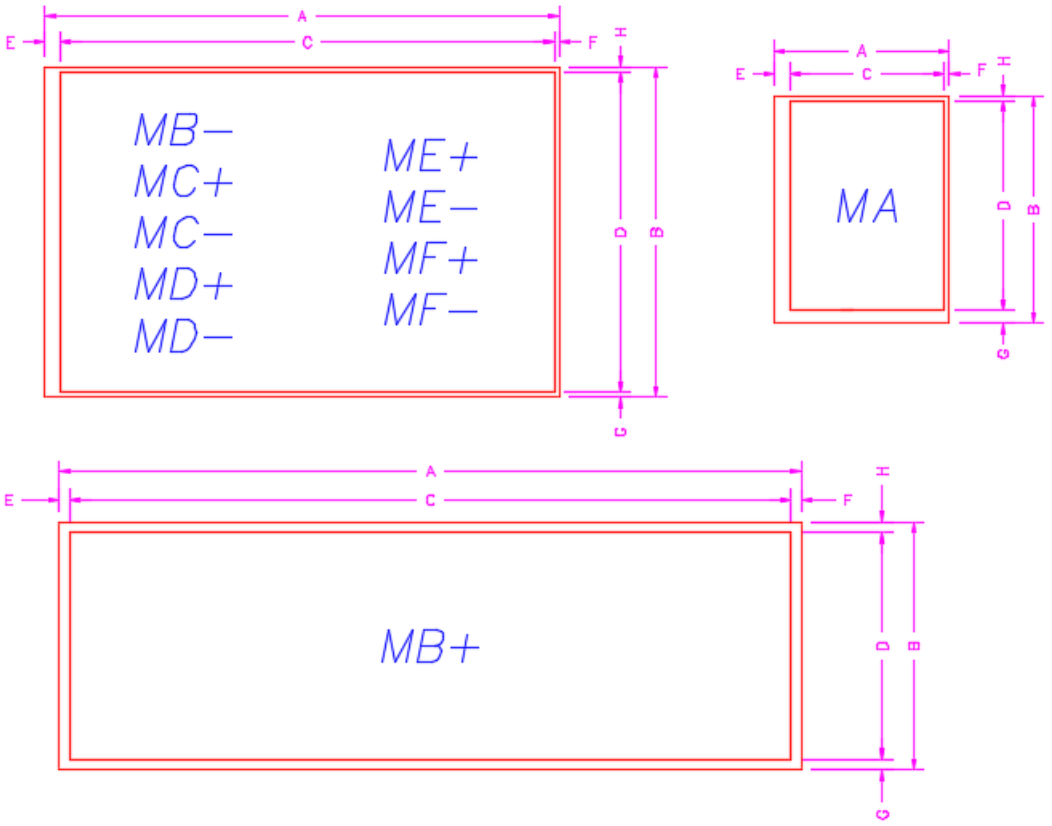
16) BORDER USES

Type of Drawings	1. **Name**	**Physical Paper Size**
Reference Details	**MA+**	8 ½” x 11”
Control Wiring Diagrams (CWD), Loop Sheets, Elementary Diagrams, Logic Diagrams and Cable Schedules	**MB-**	11” x 17”
Substation Schematics, Wiring Diagrams (used primarily by substation engineering)	**MB+**	12” x 36”
	MC-	14¾” x 20¾”
	MC+	14¾” x 26¾”
	MD-	22” x 28”
Transmission Engineering, Plan and Profiles	**MD+**	22” x 34”
General Arrangements, Layouts, Civil Power Plans, Structural, Architectural, HVAC, Lighting, Piping Orthographic, Piping Supports, Connection Drawings and Instrument Locations	**ME-**	26” x 44”
Same use as above only 6” longer	**ME+**	26” x 44”
Extreme large layouts or special needs	**MF-**	32” x 44”
P&IDs and Same use as above only 6” longer	**MF+**	32” x 50”

Foxboro drawings brought into Minnesota Power drawing system	**D_FOXBORO**	Same as MD+
Tac Harbor logic drawings	**THEC_LOGIC_BORDER**	Same as MD+

a)

BORDER TABLE								
SIZE	A	B	C	D	E	F	G	H
MA	8.5"	11"	7.5"	10.125"	0.75"	0.25"	0.625"	0.25"
MB+	36"	12"	35"	11"	0.5"	0.5"	0.5"	0.5"
MB-	17"	11"	15"	10"	1.5"	0.5"	0.5"	0.5"
MC+	26.75"	14.75"	24.75"	13.75"	1.5"	0.5"	0.5"	0.5"
MC-	20.75"	14.75"	18.75"	13.75"	1.5"	0.5"	0.5"	0.5"
MD+	34"	22"	32"	21"	1.5"	0.5"	0.5"	0.5"
MD-	28"	22"	26"	21"	1.5"	0.5"	0.5"	0.5"
ME+	44"	26"	42"	25"	1.5"	0.5"	0.5"	0.5"
ME-	38"	26"	36"	25"	1.5"	0.5"	0.5"	0.5"
MF+	50"	32"	48"	31"	1.5"	0.5"	0.5"	0.5"
MF-	44"	32"	42"	31"	1.5"	0.5"	0.5"	0.5"



d. Vendor prints

a) Vendors not using a Minnesota Power drawing number may use vendor standard.

b) Any vendor using a Minnesota Power drawing number must follow the MP drawing standards.

17) Drawing Scales:

a) Scales for plans, elevations, sections and details once established at the beginning of a project should be followed throughout. The scale should be indicated beneath the individual views.

b) Unless otherwise instructed by Minnesota Power Engineering Services, use common industry standards.

c) Some common scales are listed below:
   a) Plot Plans ----------1" = 50' to 1" = 10'
   b) General Arrangement ----------1/8", 1/4" = 1'-0"
   c) Equipment Arrangement ----------1/8", 1/4" = 1'-0"
   d) Panel Elevations ----------1 ½” = 1’-0”
   e) Schematics ----------1 to 1
   f) Plans, Elevations, and Sections ----------1/8", 1/4", 1/2” = 1'-0"
   g) Details ----------Use standard scales, be consistent.

18) Layout Space / Model Space:

a) Non-scale drawings are drafted in Model Space. Use of Minnesota Power Template borders is mandatory. All Minnesota Power borders are to be left at a scale of 1 to 1. All model space entities are to be drawn 1 to 1. These are control, schematics, and P&ID drawings.

b) All scaled drawings shall be done utilizing Layout Space. The Minnesota Power template files that are supplied to vendors are pre-set to use Layouts. View ports can then be used to adjust the visual scale of model space entities. Notes, tables & borders will use a single layout tab with whatever scaled viewports necessary; everything else will be drafted in model space.

c) All text and dimension size information is pre-set in the Minnesota Power layouts and shall not be changed without prior approval from the Minnesota Power, Drafting and Document Management group.

19) Custom Line Types

a) Minnesota Power prefers that the only line types used are those provided with the standard AutoCAD package or furnished by Minnesota Power. Custom line types without Minnesota Power Engineering Services prior approval will not be accepted on any drawings created for Minnesota Power. If approval is given, line type definition files must also be sent to Minnesota Power along with drawings.

20) Fonts and Text Style:

a) Minnesota Power prefers that the only fonts used are those provided with the standard AutoCAD package or furnished by Minnesota Power. Custom fonts without Minnesota Power Engineering Services' prior approval will not be accepted on any drawings created for Minnesota Power. If approval is given, font definition files must also be sent to Minnesota Power along with drawings. Typically, all text should be RomanS. RomanD can be utilized for emphasis such as in titles. Standard text height, as they appear on a full-size plot, will be 3/32". Large text sizes such as 1/4" may be used for titles. Do not preset the text height, but rather set it to 0", which will allow text height changes in the future. MP will allow exceptions for minimum text height and width only if it improves legibility. All text must be in English.

b) General Requirements
   a) Upper case letters should be used for all drawings.
   b) Avoid interference with other elements of the drawing by careful placement of text.
   c) If necessary, break a line rather than lettering over it.
   d) Lettering shall be placed on the layer "G-ANNO-TEXT" with color "BYLAYER". Text on random layers is unacceptable.
   e) Abbreviations should be avoided. Justify text in such a manner that when revising text to an existing text string it will grow away from and not into a drawing entity. An example would be when labeling an object on the left side, using right or middle right justification. When adding the text string, the text will not run into the symbol, thus moving the text will not be necessary.

21) Dimension Styles and Units Format

a) All entities associated with dimensions must be derived from Minnesota Power-STAND-ARCHITECTURAL dimension style format. The use of custom dimension styles is unacceptable, including but not limited to custom dimension symbols such as arrowheads, and the use of custom font styles for dimension text. The required font for dimension text will be AutoCAD RomanS and 3/32 size. Dimensions will follow the ANSI recommended format for appearance and functionality of each individual

engineering discipline. Minnesota Power-STAND-ARCHITECTURAL is the dim style that is included in the template files. Minnesota Power expects that this dimension style will work on most drawings. Dimension overrides that are necessary will be allowed if the standard dimension style is normally utilized.

b) Specifications for general system drawing dimensioning will be as follows:

   a) Dimensions will be - feet, inches, and then fractions (25’-3 1/2”).
   b) All dimensions of 1’-0” and above shall be stated in feet and inches, and all dimensions less than 1’-0” shall be inches.
   c) Dimension lines will be terminated with filled arrowheads. The arrowheads shall touch but not overrun extension lines.
   d) Avoid crossing dimension lines with extension lines or leader lines.
   e) Dimension to reference points that are practical and accessible to the contractor.
   f) Metric equivalents may be incorporated along with American Standard dimensions but shall be enclosed in parenthesis. The metric dimensions must be below or to the right of the American Standard dimensions.
   g) Dimensions shall be positioned to read from left to right or bottom to top.
   h) Dimension precision setting shall be 1/16” unless designated otherwise.

c) Dimensioning for machine and component design as well as most civil drawings will be done in decimal format. Civil drawings would include but not limited to site plans and plant coordinate systems. Dimensions on civil drawings will be shown as follows: 50.75’, 1.35’, with two digits to the right of the decimal point. Decimal dimensions that are less than one inch will be represented by placing a zero to the left of the decimal point (i.e. 0.75”not .75”).

22) Use of Colors

a) For viewing purposes, yellow cannot be used.

b) Redlining drawings, red is for changes, green is for removal, and blue is for notes that do not go on the drawing.

c) All colors should use the (USE OBJECT LINEWEIGHT) which is associated in the “monochrome.ctb”.

d) Polylines are used to control of line weights on drawings. Line weights are then associated to entities using the “PEDIT” or properties dialogue.

e) Minnesota Power standard drawings, this will give standard colors, line types and line weights before new drafting begins. Contact Engineering Services to request sample drawings.

23) Using Layers

a) Minnesota Power has layer standards in the drawing templates.

b) New layers are acceptable if they do not already exist and are needed, labeled logically and utilized properly with prior approval from Minnesota Power Engineering Services.

24) Creating New Blocks

a) **Blocks that are used in creating a drawing will be provided from Minnesota Power's standard block library.** Blocks are organized by drawing categories. These will be the only blocks permitted in the creation of drawings. If a new block is required, it can be created with the following restrictions, prior approval from Minnesota Power Engineering Services and the new block will be added to the standard block drawing.

25) Creating Details

a) If it is necessary to create a design detail the following criteria must be met. All drawing details will utilize PAPER/MODEL SPACE. All drawing details will be created 1 to 1 in Model Space. The use of Paper Space View Ports will then be utilized to scale the detail and proper dimension.

26) Specifications for Inserts

a) Inserts such as company logos, scale bars, and similar elements may be used under the following conditions:
b) All entities that make up an insert must be placed on a dedicated vendor layer named after the company providing the CAD or engineering service.
c) The creation of additional layers by inserts is discouraged.
d) No drawing entities other than those belonging to the insert are permitted on the vendor layer.

27) Revisions & Rev-Clouds

a) All new drawings will start out as revision "A" (for bids,fabrication) will be designated by letters until they are ready to be signed for construction at which time they shall become revision "0". Consecutive numbers in increments of one will designate subsequent revisions after release for construction. Revisions shall be designated on the appropriate area of the title block and shall include number, description, date and initials of the person making the revision. For substation, a drawings dash series may

be reused as a rev 0 if series has been obsolete. Ask document management for clarification.

b) There are typically three places where the revision number is displayed on each drawing. The title block, the revision block, and the engineering stamp. The title block, the revision block must be updated with each revision and match. All 3 must match if the engineering stamp is used. See relevant department's PE policy for when to use PE stamp.

c) Description drawing revision dates should be the same, the first day that you start the set or the day you check out the last drawing (when waiting for drawings release from imagesite)

d) The revised for construction portions of the drawings shall be enclosed in a "cloud". The cloud shall be on a separate layer named "G-ANNO-REVC" along with any construction notes/text that will be removed after work on the revision is complete. The actual revisions to the drawing will NOT be included on the "G-ANNO-REVC" layer.

e) If multiple projects are shown on the same drawing with different revision levels, or if a drawing is revised for construction after it has already been released to Document Management, revision triangles—placed on the G-ANNO-REVC layer—must be used.

f) • Every revision cloud in the drawing must have a corresponding revision triangle placed next to or inside the cloud.

g) • The letter or number inside each revision triangle must match the associated revision.

h) • Every revision triangle must have an associated revision description.

i) • If space is available in the revision block, the description is entered there.

j) • If the revision block has no remaining space, the description is added as a separate text on the REVC layer and placed near the revision block.

28) Notes

a) Notes should be on "G-ANNO-TEXT" layer. Locate notes along the right-hand side of the sheet. Use only note number references within the body of the drawing. All general notes for a series of drawings are to be placed on the first sheet. All other drawings of the series shall refer to the first sheet for general notes.

29) Key Plans

a) Key plans, when used, are located in the lower right side of the sheet. Orientation of the key plan must be identical to that of the plan drawing. The key plan should be small, simple and consistent for the entire project.

30) Match Lines and Drawing Limits

a) Match lines and building outlines should be in identical locations on plan drawings for all disciplines. Place match lines five or six scaled feet outside a building wall, column or grid line, and avoid locating them in congested areas. Inside buildings, locate match lines between column and grid lines. Avoid extending a drawing beyond the match lines.

31) Grid Line System

a) Coordinates - Items and facilities on plan drawings are to be located with reference to a facility/site grid system using established benchmarks. This is based on an NS and EW coordinate system established by the Minnesota Power project manager at the beginning of the project. Locations are defined simply by direction and distance from 0,0 base lines; e.g. N150.00' E1560.66'

b) Building and Structure Column Lines - Column lines are designated by numbers running from West to East and letters running from South to North.

32) North Arrow

a) Minnesota Power's standard north arrow shall be used by all disciplines.
b) If plant north differs from true north, this deviation is shown only on the plot plan or site location plan.
c) All other plans shall use plant north.
d) Placement and Orientation
    a) Place the north arrow near the upper-right corner of each plan view, outside the match lines.
    b) Orient the plan so the arrow points up whenever possible; if necessary, it may point left.
    c) All drawings representing the same plan view must maintain the same orientation.
e) Partial Plans
    a) Partial plans shall include a north arrow in the upper-right corner of the plan view.
    b) Orientation shall match the main plan view whenever possible.
f) Isometric Drawings
    a) Place the north arrow in the upper-right corner of isometric drawings unless clarity requires placing it in the upper-left corner.

33) Plotting for Minnesota Power

a) Border Templates

(1) Minnesota Power border template files are designed to be plotted 1:1.
(2) Paper size is pre-determined by Minnesota Power.
(3) Refer to the Border and Paper Size section for exact dimensions and naming conventions.

b) Standard Drawings
(1) Use monochrome.ctb (Minnesota Power standard).
(2) All pen widths should be set to 0.010 because line weights are controlled by Polylines.

c) Station One-Lines
(1) Use acad.ctb instead of monochrome.ctb.

d) Plotter Settings
(1) Plot Offset: Center the plot
(2) Exception: MB+ (refer to MB+ documentation for details)
(3) Plot Scale: Fit to Paper (box checked)
(4) Plot Area: Extents
(5) Preview: Always perform a full preview to verify accuracy before plotting.

34) Drawing Control

a) Minnesota Power uses ImageSite (IMS) as the official system for document storage, control, and retrieval.
b) All drawings, revisions, and associated engineering documents are managed through Engineering Services – Document Management.
c) For support, corrections, or document-control questions, contact: engsvcsdocmgmt@mnpower.com

35) Drawing Process

a) Obtaining drawings from IMS
b) Starting a new drawing
c) Use of PE stamps (see PE process/policy)
d) Completing a drawing
e) Submitting drawing to Drawing Control for document management

36) Procedure

a) Existing drawing process
a) When creating new drawings first do some research before you begin.

(1) Use ImageSite, department personnel and/or Project Managers to see if any existing drawing numbers can be used, before attaining a new number.

b) If starting a new drawing skip to section called “New drawing process” (item b) otherwise continue this path to revise an existing drawing.

c) Locate drawing(s) in ImageSite you want to update and “Add to Sets”.

d) From ‘Sets’ select the drawing(s), you want to check out by checking the box.

e) Next, either click the ‘Gear’ icon or right click mouse to select ‘Check-Out’. A “CheckOut and Download Files” box will appear with an option to download. Check the box next to the file(s) and click on ‘Set Download Folder(s)’. A ‘Select target folder’ screen will pop-up, where you can set your folder location. Set the folder location and then click “Start CheckOut and Download All” button.

f) All drawings should be worked on within the Chester2 directory.

(1) The Chester 2 directory has been set up with some Windows basic security to keep all working drawings in a semi secure central location, not to mention it helps other users find the drawings with some relative ease.

g) Review the alpha, broad and fine fields for revisions.

(1) Refer to the various tables available in ImageSite under Misc\Drafting and Document Management\Drawing Documents\ for the alpha, broad and fine field information.
(a) Direct link to ImageSite folder 'DRAWING DOCUMENTS': https://dulpapimgsit01/ims/EnterSite?vectorid=523319

b) PE Policies

a) For the engineer’s convenience, the PE stamp will be placed on all drawings unless otherwise noted by the engineer.
b) Policies to look at:
c) https://stream.allete.com/content/2234119/professional-engineering-certification#certifying
d) Y:\CHESTER2\Drafting and Document Management\Standards\ Power Delivery Engineering PE Policy.pdf

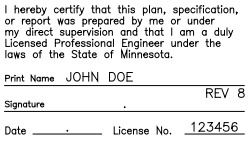
(1) Insert the engineer’s PE stamp for the current project.

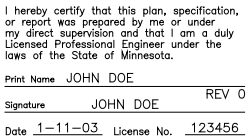
(a) A complete set of the PE Stamps and associated blocks can be found in \\p\projects\CADD\private\Chester\MP ACAD Library\Electrical\CWD\CWD blocks 2-2-12.dwg.

(b) The stamps are intended to be used within AutoCAD's Design Center.

(2) Update the revision field in the PE stamp block with the current revision number.

(3) If there is, a "REV 0" PE stamp this one will stay with all revisions for the life of the drawing and the latest revision will replace the current one. Remove the "Signature On File" block. Update its written signature field with the engineer's name.


I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
Print Name JOHN DOE
REV 8
Signature .
Date . License No. 123456


I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.
Print Name JOHN DOE
REV 0
Signature JOHN DOE
Date 1-11-03 License No. 123456

e) Exceptions to PE Stamp. There are times when the latest PE stamp revision number will not match the drawing's latest revision number. The following are a couple examples and how to handle them:

(1) As-builts that have no engineering changes following construction and the removal of "rev cloud(s)" are the changes to the drawing that will NOT need PE review.

(2) Updating general title block information does NOT require a PE review.

f) When the drawing is complete, the engineer signs and dates the PE Stamp. In addition, the "Approved" fields on the Title Block (on new drawings) and the Revision Block must be initialed.

(1) Construction project drawings requires the initials from a separate peer reviewer not the engineer doing the work.

(2) Drawings not requiring a PE Stamp are complete when the "Approved" field on the revision block is initialed.

g) Once the drawing(s) are signed off, scan the wet signature drawing(s) and renamed the file to match the electronic dwg file name as a tiff or pdf.

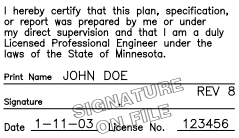
h) Move the electronic tiff/pdf file(s) to the appropriate project folders located on \\p\projects\CADD\private\Chester\CHESTER2_ImageSiteUploads directory. For example Generation Thermal Tifs.

i) Next update the drawing file(s).

(1) Place the "Signature On File" stamp over the PE stamp.

(2) Update PE stamp's date field with the date from the wet signature.

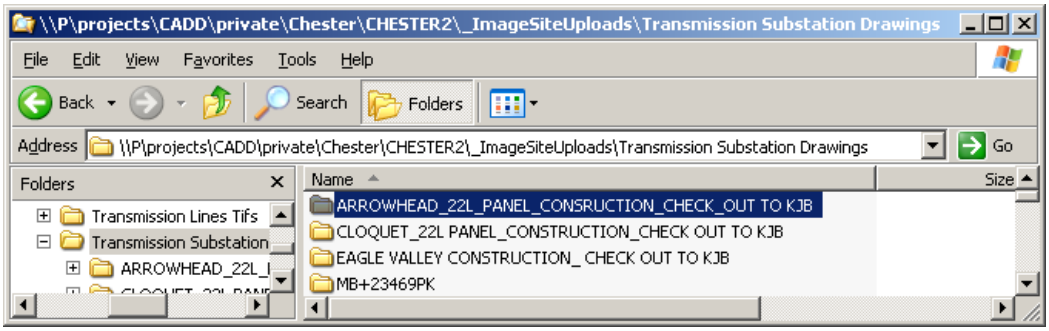
(3) Update the drawing's Title Block "Approved" field (on new drawings) and Revision Block "Approved" field to match with the wet initials.



j) Move the dwg (and tiff file(s) if hybrid) to the \\p\projects\CADD\private\Chester\CHESTER2_ImageSiteUploads directory under the appropriate project folder labeled "Drawings" example "Generation Thermal Drawings".

k) Exception to above, S&T Engineering (Substation and Telecommunication Engineering) control drawings created or revised for construction projects.

(1) Create a separate folder at \\p\projects\CADD\private\Chester\CHESTER2_ImageSiteUploads directory under



the appropriate project folder labeled "Drawings" example "Transmission Substation Drawings". The name of the folder will contain the site and short project description.

(2) Move the dwg (and tiff file if hybrid) to this folder

l) Issue drawing(s) as required per CDS 205.01 and other plant issuing procedures (Direct link to ImageSite folder 'ISSUING STANDARDS': https://dulpapimgsit01/ims/EnterSite?vectorid=523318)

(1) Wet signature drawing(s) are used for Office file.

c) New drawing process

a) If a new drawing is needed follow the file naming structure standard found in section 11.0 of this procedure, Engineering Services Drawing Process & Standards.

b) Check out a new drawing number from the Drawing Number Database, which is located at \\P\Projects\CADD\private\Chester\CHESTER2\Drawing Number Data Base

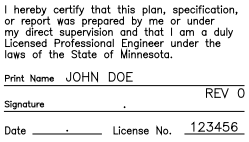
c) Drawing templates are available for the different disciplines and are located at \\p\projects\CADD\private\Chester\Cad_Standards.

d) Borders and other items needed for working drawings can be found in the "Chester" directory (\\p\projects\CADD\private\Chester\Cad_Standards).

e) A PE stamp shall be placed on all drawings for the engineer's convenience unless otherwise noted by engineer. A complete set of PE Stamp and associated blocks are found in \\p\projects\CADD\private\Chester\MP ACAD Library.

(1) Update the revision field in the PE stamp block with "Rev 0".

(2) Place the stamp in the lower right hand corner or as close to that as possible. This location works so if the drawing is folded one can see the PE stamp close to the drawing title block.


I hereby certify that this plan, specification, or report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Print Name JOHN DOE

REV 0

Signature .

Date . License No. 123456

f) Follow 35axii thru 35axvi to complete new drawings process.

d) (reserve)

37) Obsolete Drawings

a) An Obsolete Drawing is one that no longer contains any valid information and is not being replaced by a new drawing.

b) If equipment and/or wiring has been disconnected but still in place it will be the discretion of the appropriate personnel to determine if the drawing should be maintained in the active file with documentation that it has been removed from service or abandoned in place.

38) Superseded Drawings

a) To replace a drawing with another.

b) The purpose of a superseding drawings is to replace the information shown on any existing drawing entirely with a new drawing. This new drawing would require a new drawing date and appropriate signatures.
c) If a new CADD and or Manual drawing replaces an existing CADD or Manual drawing than it would need the superseded form. A new drawing date and appropriate signatures will be on the new drawing
d) If a new drawing replaces a portion of an existing drawing, the existing drawing should be updated and maintained in the active file. The New drawing should reflect that it supersedes that existing drawing in part, on the bottom of the drawing.

39) Approval

a) This procedure is for reference only.

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT D-2

REQUIRED FILE DELIVERABLES

Required File Deliverables

- **Signed Drawing:** Single page signed TIFF or PDF (no multi-page files).
- **CAD Files:** One .dwg file per drawing (no multi-tabbed drawings).
- **Hybrid Drawings:** Must include associated XREF files with the .dwg. – NO bound or embedding
- **Colored Tiff or PDF files – Wisconsin only**
- **MP CAD blocks must be used – no exploding or redrawing blocks**
- **Combined PDF files for Electrical, Relay and Control, Civil/Structural, etc.**
- **Test switch process ?/?**

Electronic File Naming Convention

- **Format:** [BorderSize]-[DrawingNumber]_[DashValue]_[SheetNumber].dwg
- **Separators:** Use underscores (_) between elements.
- **Dash Value:** Always two digits if present. If omitted, use double underscores before the sheet number.
- **Components:**
  - ME- = Border size (see Section 14aiii of Drafting Standard)
  - 12345 = 5-digit drawing number
  - 03 = 2-digit dash value
  - 2 = Sheet number
  - .dwg = File extension (NEED TO INCLUDE .TIF AND .PDF statement)

Example:
ME-12345_03_2.dwg
ME-12345__2.dwg *(no dash value)*
ME-12345_03_2.tiff
ME-12345_03_2.pdf

ATTACHMENT D
BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT E
DIVISION OF RESPONSIBILITY

EXHIBIT E-1 – DIVISION OF RESPONSIBILITY

*preliminary provided by Owner final to be performed by Contractor

Note: 'R' shall mean Responsible, 'S' shall mean Support

EXHIBIT E-1
DIVISION OF RESPONSIBILITY

BESS BOP + HV	Supplier	Contractor	Owner
1.0 - ENGINEERING			
BESS Conceptual Site Layout			
Overall Preliminary Design		R	S
BESS Final Site Layout			
Overall Final Design	S	R	S
Sizing			
Specifying cycles, use case			R
Aux power supply requirements	R	S	
Round trip efficiency	R	S	
DC Block	R	S	
PCS	R	S	
Overbuild/augmentation design	R	S	
Equipment Configuration	R	S	
Equipment Quantities	R	S	
Civil			
Erosion Control		R	
Grading		R	
Trenching		R	
Stormwater		R	
Paving		R	
Site Finishing		R	
Landscaping		R	
Site Signage Plan		R	
Structural			
Loading Requirements	R	S	
Lifting Requirements	R	S	
Foundations	S	R	
Equipment Anchorage	R	S	
Structures	S	R	
Electrical			
DC / LV Collection System		R	
MV Collection System		R	
Auxiliary Power System (including metering requirements)	S	R	S
Backup/Secondary Auxiliary Power System (if required)	S	R	S
UPS		R	
Cable Sizing		R	
Grounding		R	
Protective relay design		R	
Relay Settings		R	
Lightning protection		R	
Site Lighting		R	
Control System/SCADA			
BMS	R	S	
EMS	R	S	S
Telecommunication Network & Design		R	S
SCADA		R	S
Controls Narrative		R	S
Fire Detection and Suppression (if required)			
Network Design	S	R	
Equipment Specification	S	R	S
Hazard Mitigation Analysis (HMA)	S	R	
FMEA	R	S	
Emergency Response Plan (ERP)		R	S
Supporting Documentation for UL 9540 Product Listing or Field Certification	R	S	
UL 9540 System Field Certification	R	S	
UL 9540A Testing and Test Reports	R	S	
Thermal runaway mitigation system	R	S	
Fire protection design (alarm and suppression)	R	R	
Explosion control	R	S	
Water supply (pending AHJ or site requirements)	S	R	S
Pressure/Flow Calculations		R	
NFPA 68 Calculations (as applicable to battery enclosure)	R	S	
NFPA 69 Calculations (as applicable to battery enclosure)	R	S	
NFPA 855 Checklist	R	R	S
Substation			
MV System		R	
HV System		R	
Relaying and Protections		R	
Metering Requirements		R	
Transmission (if applicable)			
Electrical Line Design		R	S
Pole Specification and Design		R	S
Foundation design		R	
Interconnection reaction loads		S	R
Utility Interconnection		S	R
Studies			
Interconnection Study		S	R
Relay Coordination		R	
Corrosion		R	
Line Loss Study (AC and DC)		R	
Load Flow/Reactive Power Study		R	
Cable Thermal (Sizing) Study		R	
Short-Circuit Study (AC and DC)		R	
Arc-Flash Study (AC and DC)		R	
Grounding		R	

*preliminary provided by Owner final to be performed by Contractor

Note: 'R' shall mean Responsible, 'S' shall mean Support

EXHIBIT E-1
DIVISION OF RESPONSIBILITY

BESS BOP + HV	Supplier	Contractor	Owner
Voltage Drop		R	
Harmonic Study		R	
Insulation Coordination Study		R	
Protection Coordination Study		R	
Lightning Risk Assessment		R	
Transient Studies (TRV, TrOV)		R	
Photometric Study		R	
Specifications			
Equipment Procurement Specifications - Owner Provided		S	R
Equipment Procurement Specifications - Contractor Provided		R	S
Metering (Station Service, BESS)		S	R
Construction Specifications		R	S
North American Electric Reliability Corporation (NERC)			
PRC-019-2 Coordination of Generating Unit or Plant Capabilities, Voltage Regulating Controls, and Protection		S	R
PRC-024-3 Frequency and Voltage Protection Settings for Generating Resources		S	R
PRC-025-2 Generator Relay Loadability		S	R
PRC-027-1 Coordination of Protection Systems for Performance during Faults		S	R
MOD-025-2 Verification and Data Reporting of Generator Real and Reactive Power Capabilities and Synchronous Condenser Reactive Power Capability		S	R
MOD-026-1 Verification of Models and Data for Generator Excitation Control System or Plant Voltage/VAR Control Functions		S	R
MOD-027-1 Verification of Models and Data for Turbine/Governor and Load Control and Active Power/Frequency Control Functions		S	R
FAC-008-5 Facility Ratings		S	R
NERC-CIP Low Impact Documentation		R	
Project Management			
Engineering and project management of BESS scope		R	
BESS Equipment Warranty	R	S	
2.0 - PROCUREMENT			
Structural			
Foundation/Concrete/Rebar		R	
Piles (if required)		R	
Equipment Anchorage		R	
Steel (if required)		R	
Miscellaneous Material		R	
Batteries			
Battery Modules	R	S	
Battery Enclosure	R	S	
Thermal Management System	R	S	
BMS	R	S	
Communications within Enclosure	R	S	
Auxiliary Power within Enclosure	R	S	
DC jumpers within Enclosure	R	S	
Uninterruptible Power System (UPS) within enclosure	R	S	
Fire Detection/Suppression within enclosure	R	S	
First Responder Station	S	R	
Hazardous Gas Detection System within enclosure	R	S	
Explosion Control System and/or Ventilation within enclosure	R	S	
Factory Acceptance Testing (FAT)	R	S	S
Shipping Equipment to Project Site	R	S	
Coordination to Receive Equipment on Project Site	S	R	
Power Conversion System (PCS)			
Inverter	R	S	
MV Switchgear, Disconnect Switches, Other Protection	R	S	
Inverter Step-Up Transformer	R	S	
Factory Acceptance Testing (FAT)	R	S	S
Shipping Equipment to Project Site	R	S	
Coordination to Receive Equipment on Project Site	S	R	
Control System/SCADA			
Controller/EMS Hardware (switches, i/o cards)	R	S	
Controller/EMS Software/Programming	R	S	
Controls Enclosure		R	
SCADA Hardware (RTU, firewall, switches, servers, HMI, etc.)		R	S
SCADA Software		R	S
Shipping Equipment to Project Site		R	
Coordination to Receive Equipment on Project Site		R	
Substation Equipment			
Main Power Transformer		R	S
MV Breakers		R	
HV Breakers (at interconnection voltage)		R	S
Misc. Substation (CCVT, CT/PT, metering, bus, lightning protection, structures, relaying, etc.)		R	
Cabling			
MV Cable		R	
LV Cable		R	
DC Cable		R	
Communication Cable (Fiber and Cat6)		R	
Conduit and stub ups (as needed)		R	
Cable terminations (as needed)		R	
Shipping Equipment to Project Site		R	
Coordination to Receive Equipment on Project Site		R	
Auxiliary Power System			
Auxiliary Power Transformers		R	
Distribution Switchboards/Panelboards		R	
Shipping Equipment to Project Site		R	
Coordination to Receive Equipment on Project Site		R	
Auxiliary Load Metering (if required)		R	S

*preliminary provided by Owner final to be performed by Contractor

Note: 'R' shall mean Responsible, 'S' shall mean Support

EXHIBIT E-1
DIVISION OF RESPONSIBILITY

BESS BOP + HV	Supplier	Contractor	Owner
BESS Site Meter		R	S
Standalone MV Switchgear		R	
Other			
Water supply (if applicable)	S	R	S
Metering (Station Service, BESS)		R	S
3.0 - PRELIMINARY WORK/PERMITTING			
General Permitting			
Interconnect Approval		S	R
Site control, Easements, and Right-of-Ways		R	
Environmental Investigations and Studies (as required)		R	
Site Survey (ALTA, topographic, boundary, property)*		R	
Preliminary Hydrology*		R	
Preliminary Geotechnical Investigation Report (including thermal and electrical resistivity)*		R	
Local Fire Authority Approval	S	R	S
Non-Construction Permitting			
Noise Study		R	
Environmental Site Assessment		R	
Cultural Resource Survey		R	
Archaeological Survey		R	
Traffic Study		R	
Construction Permitting			
Stormwater Permit (SWPPP)		R	
Temporary Facilities/Power		R	
Federal Aviation Administration (FAA) Obstruction Evaluation/Airport Airspace Analysis (OE/AAA)		R	
Electrical		R	
Grading		R	
Building		R	
Heavy Haul/Route Survey		R	
Fire		R	
Demolition		R	
Site Clearing/Preparation		R	
All other permits and approvals required by local, state, federal authorities		R	
Temporary Construction Facilities			
Construction Facilities Space		R	
Contractor Construction Facilities (office space/trailers, laydown)		R	
Owner Construction Facilities		R	S
Craft Parking		R	
Construction Power		R	
Construction Water		R	
Construction Internet		R	
Sanitary Services		R	
Trash Services		R	
Site Security during Construction		R	
Temporary Fencing		R	
Temporary On-Site Storage		R	
Removal of Temporary Facilities Upon Completion of Construction		R	
Remediation		R	
Site Development			
Project site internet connectivity		R	
Site Access Roads/routes from major highway to site		R	
Fire marshal/fire department		R	S
Other civil site preparation, including contaminated soil removal, soil improvements, removal, etc.		R	
Surveys			
ALTA Survey including boundary and topography*		R	
Geotechnical Investigation*		R	
Site Coordination			
Trailers and transportation of trailers for all site personnel (Contractor, Equipment OEM, Owner, Interconnecting Utility)		R	
Shipping Equipment to Project Site		R	
Coordination to receive delivery on site	S	R	S
Detailed inspection upon delivery	S	R	S
Equipment rigging on site	S	R	
Lifting requirements and Installation Manuals	R	S	
On-site storage of batteries	S	R	
4.0 - CONSTRUCTION AND INSTALLATION			
Civil			
Erosion Control		R	
Site Clearing and Grubbing		R	
Rough Grading		R	
Stormwater Control		R	
Stormwater Collection/Retention (if required)		R	
Permanent Site Fencing		R	
Fine Grading		R	
Site Finishing		R	
Surfacing		R	
Roadways		R	
Landscaping		R	
Material/Compaction Testing Coordination		R	S
Trenching		R	
Structural			
Foundation Excavation		R	
Piles (if required)		R	
Concrete Work		R	
Equipment Anchorage		R	
Material/Compaction Testing Coordination		R	S
Electrical			

*preliminary provided by Owner final to be performed by Contractor

Note: 'R' shall mean Responsible, 'S' shall mean Support

EXHIBIT E-1
DIVISION OF RESPONSIBILITY

BESS BOP + HV	Supplier	Contractor	Owner
Below Grade Electrical		R	
Above Grade Electrical		R	
Grounding		R	
Equipment Installation		R	
Auxiliary Power System		R	
Site Lighting		R	
Permanent Site Security		R	S
Cable Installation/Termination (DC, LV, MV, and Communication)		R	
Field Testing of Cables/Terminations		R	
Enclosure Setting	S	R	
PCS Setting	S	R	
Metering (Station Service, BESS)		R	S
Installation/racking of battery modules within containers (If applicable)	R	S	
Control System/SCADA			
EMS Panel Installation	S	R	
SCADA Installation		R	
Fire Detection & Suppression (if required)			
Water supply (including hydrants or storage tanks, metering, backflow prevention)		R	
Thermal Imaging/Flame/Heat Cameras		R	
Local Fire Alarm Panel		R	
First Responder Station		R	
Connection to Offsite Network Operation Center and/or Central Station Monitoring Facility		S	R
AHJ approval for site-wide requirements	S	R	
Substation			
MPT Set, Dress, Fill, and Test		R	S
MPT Secondary Containment (if required)		R	
Equipment Installation		R	
Relay Setting		R	
Metering Requirements		R	
Testing/Services Specifications		R	
Gen-Tie to Interconnection Point (if required)		R	
Deliveries (Rigging and Offloading)			
Battery Containers		R	
Inverters & Transformers (PCS)		R	
EMS Panel		R	
SCADA		R	
Junction boxes and Switchgear		R	
Panelboards and AUX Equipment		R	
Relays & Metering		R	
Cabling & Conduit		R	
Structural Materials for Foundations		R	
Auxiliary Panel		R	
Auxiliary Transformer		R	
Construction Management			
Construction Management		R	
Site Safety		R	
Quality Management		R	
Lockout/Tagout Program		R	
On site Storage			
Temporary Storage of Battery Containers on Site	S	R	
Storage of Spare Parts		R	
5.0 - COMMISSIONING			
Battery Commissioning			
Commissioning Plan	R	S	S
Pre-Energization Commissioning	S	R	
Post-Energization Commissioning	R	S	
Performance Testing	R	S	S
PCS Commissioning			
Commissioning Plan	R	S	S
Pre-Energization Commissioning	S	R	
Post-Energization Commissioning	R	S	
Performance Testing	R	S	S
BOP Commissioning			
Pre-Energization Commissioning		R	
Post-Energization Commissioning		R	
Fire protection system commissioning (BOP equipment)	S	R	
BESS Overall			
Functional Test	R	S	
BESS performance verification testing (capacity testing)	R	S	
Site-Wide (BESS + Substation)			
Site Controller/Site-wide EMS		R	S
Network Functional Testing		R	S
Substation installation completion checklist and mechanical completion		R	
Substation commissioning		R	
BESS and substation substantial completion	S	R	
BESS and substation turnover documentation	S	R	
6.0 - Miscellaneous Items			
O&M Spare Parts	R	S	S
BESS & Site Operations Training	R	S	S
EMS Training	R	R	S
First Responder Training	S	R	S
Commissioning of remaining BOP equipment and systems not specifically listed		R	

ATTACHMENT D

BESS (Li-ion) TECHNICAL SPECIFICATION

EXHIBIT F

APPROVED MANUFACTURERS

EXHIBIT F-1 – APPROVED MANUFACTURERS

EXHIBIT F-1
APPROVED MANUFACTURERS

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EXHIBIT F-1
APPROVED MANUFACTURERS

1.0 EXHIBIT INFORMATION

1.1 Purpose

1.1.1 This Exhibit lists the approved manufacturers that the Contractor shall utilize on the Project. Alternative manufacturers may be considered but are subject to Owner's approval.

1.2 Definitions

1.2.1 Unless defined in Exhibit A-1 (*Scope of Work (BESS BOP)*), terms that begin with an upper case shall have the meaning defined in the Agreement.

1.2.2 See Exhibit A-1 (*Scope of Work (BESS BOP)*) for respective meanings of terms used in this Exhibit, unless otherwise defined in this Exhibit.

2.0 BESS YARD APPROVED MANUFACTURERS

2.1 Wire and Cable

2.1.1 Aetna

2.1.2 American Wire Group

2.1.3 Belden

2.1.4 Cerro Wire

2.1.5 Coleman Wire

2.1.6 Corning Cable

2.1.7 Dekoron Wire

2.1.8 Encore

2.1.9 General Cable

2.1.10 Lake Cable

2.1.11 Okonite

2.1.12 Optical Cable Corporation

2.1.13 Prysmian Group

2.1.14 Rockbestos-Suprenant

2.1.15 Service Wire

2.1.16 Southwire

2.2 Conduit and Fittings

2.2.1 Allied Tube and Conduit Corporation

2.2.2 Triangle PWC, Inc

2.2.3 Republic Steel Corporation

2.2.4 Appleton

2.2.5 Crouse Hinds

2.2.6 Western Tube and Conduit Corporation

2.2.7 Robroy Industries

2.2.8 Triangle PWC, Inc. (Korkap)

2.2.9 Occidental Coating Company

2.2.10 Anaconda American Brass Company

2.2.11 Electri Flex Company

2.2.12 Champion Fiberglass

2.2.13 United Fiberglass of America

2.2.14 FRE Composites

2.2.15 Carlon

2.2.16 JM Eagle

2.2.17 Heritage Plastics

2.3 Cable Tray

2.3.1 Chalfant

2.3.2 M.P. Husky

2.3.3 Legrand/Cablofil

2.3.4 Eaton Cooper B-Line

2.3.5 Cope

2.3.6 MonoSystems

2.4 Fire Resistive Coatings

2.4.1 Carboline

2.4.2 Flamemaster

2.4.3 Bio Fireshield

2.4.4 Firestops

2.4.5 Dow Corning Corporation

2.4.6 Bio Fireshield

2.4.7 Minnesota Mining and Manufacturing (3M)

2.5 Panelboards and Switchboards

2.5.1 GE

2.5.2 Eaton / Cutler-Hammer

2.5.3 ABB

2.5.4 Square D

2.5.5 Siemens Energy

2.6 480V Transformers (LV Winding)

2.6.1 Hitachi Energy

2.6.2 Eaton Cooper

2.6.3 WEG

2.6.4 Virginia Transformer

2.6.5 Howard Industries

2.6.6 Maddox

2.7 Protection Relays

2.7.1 Schweitzer Engineering Laboratories

2.8 Meters

2.8.1 Schweitzer Engineering Laboratories

2.8.2 ION

2.9 Fiber Patch Panels

2.9.1 Corning

2.9.2 Tripp Lite

2.9.3 Panduit

2.9.4 Belden

2.10 SCADA

2.10.1 Emerson

2.10.2 Vertech

2.10.3 Inductive Automation

2.10.4 Trimark

2.10.5 Power Factors (AlsoEnergy)

2.11 BESS

2.11.1 Tesla

2.11.2 Fluence

2.11.3 Sungrow

2.11.4 Canadian Solar

2.11.5 LG

2.11.6 Hithium

2.11.7 Hanwha Q Cells

2.11.8 Trina

2.11.9 Wartsila

2.11.10 EPC Power

2.11.11 Power Electronics

3.0 SUBSTATION APPROVED MANUFACTURERS

3.1 600V Control Cable (Shielded)

3.1.1 Encore

3.1.2 General Cable

3.1.3 Lake Cable

3.1.4 Okonite

3.1.5 Service Wire

3.1.6 Southwire

3.2 Instrumentation and Fiber Optic Cable

3.2.1 Corning Cable

3.2.2 Optical Cable Corporation

3.2.3 Belden

3.2.4 SEL

3.3 Medium Voltage Circuit Breakers

3.3.1 ABB

3.3.2 Siemens Energy

3.4 High Voltage Circuit Breakers

3.4.1 Hitachi Energy

3.4.2 MEPPI

3.4.3 Siemens Energy

3.5 Power Transformers

3.5.1 Hitachi Energy

3.5.2 WEG

3.5.3 HD Hyundai Electric

3.5.4 Siemens Energy

3.5.5 HICO

3.6 Disconnect Switches

3.6.1 Mindcore

3.6.2 Pascor

3.6.3 SEECO

3.7 Reactor Banks (if applicable)

3.7.1 GE

3.7.2 Trench

3.7.3 ABB

3.8 Capacitor Banks (if applicable)

3.8.1 Hitachi Energy

3.8.2 Siemens Energy

3.9 Surge Arrestors

3.9.1 Siemens Energy

3.9.2 Hubbell

3.9.3 ABB

3.9.4 GE

3.10 Connectors and Fittings

3.10.1 Burndy

3.10.2 Travis

3.10.3 Erico

3.10.4 Hubbell

3.10.5 AFL

3.11 Battery System

3.11.1 BAE

3.11.2 Enersys

3.11.3 East Penn

3.12 Insulators

3.12.1 LAPP

3.12.2 NGK

3.13 Protective Relaying

3.13.1 Schweitzer Engineering Laboratories

3.13.2 ABB

3.13.3 GE

3.14 Prefabricated Control Enclosure

3.14.1 Avail Enclosure Systems

3.14.2 Crown Technical Systems

3.14.3 Electrical Power Products

3.14.4 Keystone Electrical Manufacturing Inc.

3.14.5 Powell Industries

3.14.6 Sabre Industries

3.14.7 Trachte

3.15 High Voltage and Medium Voltage Potential Transformers

3.15.1 Hitachi Energy

3.15.2 Trench

3.15.3 Ritz

3.16 Capacitor-Coupled Voltage Transformers

3.16.1 Hitachi Energy

3.16.2 Trench

3.17 Station Service Voltage Transformer – MV Oil Filled

3.17.1 Jerry's Electric

3.17.2 Hitachi Energy

3.17.3 ABB (Kuhlman)

3.17.4 RESCO

3.17.5 Howard

3.17.6 Cooper Power System

3.17.7 Central Moleney

3.17.8 Southwest Electric

3.18 Station Service Voltage Transformer– HV Oil Filled

3.18.1 Trench

3.18.2 Hitachi Energy

3.19 Station Service Voltage Transformer – Pad Mount MV Distribution

3.19.1 ABB

3.19.2 Eaton

3.19.3 Siemens Energy

3.19.4 Schneider Electric

3.20 RTU

3.20.1 Novatech Orion

3.21 Wave Trap (if applicable)

3.21.1 Hitachi Energy

3.21.2 Trench

3.22 Stand Alone Metering Current Transformers (if applicable)

3.22.1 Hitachi Energy

3.22.2 Trench